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A study of the possible effects of the freshman physical education program at Massachusetts State College on the strength tests and physical fitness indices.

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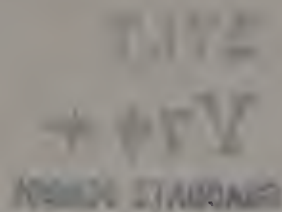
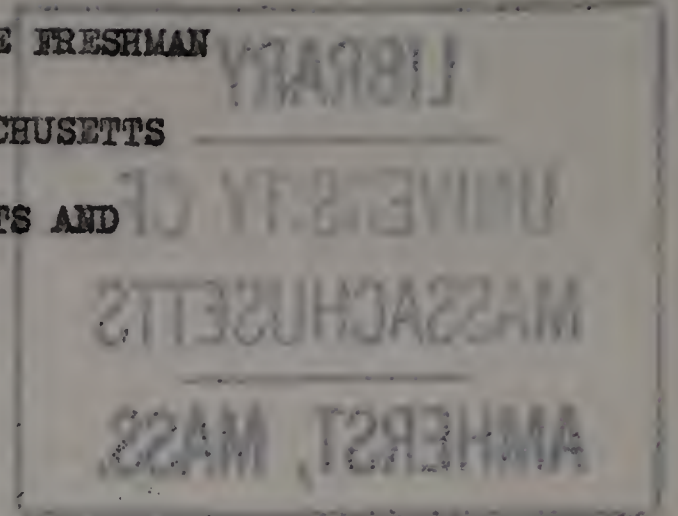
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A STUDY of the POSSIBLE EFFECTS of the FRESHMAN
PHYSICAL EDUCATION PROGRAM AT MASSACHUSETTS
STATE COLLEGE ON THE STRENGTH TESTS AND
PHYSICAL FITNESS INDICES

VINCENT - 1939

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A STUDY OF THE POSSIBLE EFFECTS OF THE FRESHMAN
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STATE COLLEGE ON THE STRENGTH TESTS AND
PHYSICAL FITNESS INDICES



- by -

ROBERT W. VINCENT

Submitted in partial fulfillment of the
requirements for the degree of Master of Science
in Massachusetts State College, Amherst

1939

TABLE OF CONTENTS

Chapter		Page
I.	INTRODUCTION OF THE PROBLEM.....	1
II.	STATEMENT OF PROBLEM PLUS SIMILAR STUDIES IN THE FIELD..	2
III.	THE BROAD LIMITATIONS OF THE PROBLEM AND PROCEDURE.....	9
IV.	PRELIMINARY TESTS.....	11
V.	THE ROGERS' PHYSICAL FITNESS INDEX TEST.....	14
VI.	THE PHYSICAL FITNESS INDEX TEST AS GIVEN AT MASSACHUSETTS STATE COLLEGE.....	18
VII.	CONCLUSIONS.....	68
	BIBLIOGRAPHY.....	69

TABLE OF GRAPHS

Graph	Page
I. Physical Fitness Index Scores of Whole Group taken in September, 1938.....	28
II. Physical Fitness Index Scores of Whole Group taken in April, 1939.....	29
III. Comparison of Physical Fitness Index Scores taken in September, 1938 and April, 1939.....	30
IV. Strength Index Scores of Whole Group taken in September, 1938.....	32
V. Strength Index Scores of Whole Group taken in April, 1939.....	33
VI. Comparison of Strength Index Scores taken in September, 1938 and April, 1939.....	34
VII. Physical Fitness Index Scores of Football-Basketball Group taken in September, 1938.....	36
VIII. Physical Fitness Index Scores of Football-Basketball Group taken in April, 1939.....	37
IX. Comparison of P. F. I. Scores taken in September, 1938 and April, 1939.....	38
X. Strength Index Scores of Football-Basketball Group taken in September, 1938.....	40
XI. Strength Index Scores of Football-Basketball Group taken in April, 1939.....	41
XII. Comparison of Strength Index Scores of Football-Basketball Group taken in September, 1938 and April, 1939.....	42
XIII. Physical Fitness Index Scores of Swimming Group taken in September, 1938.....	44
XIV. Physical Fitness Index Scores of Swimming Group taken in April, 1939.....	45
XV. Comparison of Physical Fitness Index Scores of Swimming Group taken in September, 1938, and April, 1939.....	46
XVI. Strength Index Scores of Swimming Group taken in September, 1938.....	48

Graph	Page
XVII. Strength Index Scores of Swimming Group taken in April, 1939.....	49
XVIII. Comparison of Strength Index Scores of Swimming Group taken in September, 1938 and April, 1939.....	50
XIX. Physical Fitness Index Scores of Track Group taken in September, 1938.....	52
XX. Physical Fitness Index Scores of Track Group taken in April, 1939.....	53
XXI. Comparison of Physical Fitness Index Scores of Track Group taken in September, 1938 and April, 1939.....	54
XXII. Strength Index Scores of Track Group taken in September, 1938.....	56
XXIII. Strength Index Scores of Track Group taken in April, 1939.....	57
XXIV. Comparison of Strength Index Scores of Track Group taken in September, 1938 and April, 1939.....	58
XXV. Relative Physical Fitness Index Scores of Football-Basketball, Swimming, and Track Groups taken in September, 1938.....	60
XXVI. Relative Physical Fitness Index Scores of Football-Basketball, Swimming, and Track Groups taken in April, 1939.....	61
XXVII. Relative Strength Index Scores of Football-Basketball, Swimming, and Track Groups taken in September, 1938..	63
XXVIII. Relative Strength Index Scores of Football-Basketball, Swimming, and Track Groups taken in April, 1939.....	64
XXIX. Comparative Mean Physical Fitness Index Scores of Football-Basketball, Swimming, and Track Groups taken in September, 1938 and April, 1939.....	66
XXX. Comparative Mean Strength Index Scores of Football-Basketball, Swimming, and Track Groups taken in September, 1938 and April, 1939.....	67

TABLE OF CHARTS AND ILLUSTRATIONS

	Page
I. Freshman Activity Survey.....	21
II. Physical Education Unit Plan.....	22
III. List of Team Game Participation Electives.....	23
IV. Physical Education Department Physical Examination Record (sample).....	12
V. Physical Fitness Index Physical Record Card (sample)	16

Chapter I.

INTRODUCTION

1/ Physical Education in Massachusetts has made great strides during the past year, both professionally and in public interest and support. Many types of tests have come into use in the schools of the state to measure physical abilities, aptitudes, capacities, and strengths, many schools have set up tests of their own to establish their pupils' place in the physical education program according to physical ability. Grouping, according to athletic ability, physical ability, and individual strength, is the common practice in the modern physical education program.

2/ "A test is useful in education only if it helps the educator to serve his pupil better, and the specific usefulness and limitations of any tests should be known and observed, so that each type of measurement will be used only for the purposes for which it is adapted."

"If the teacher or administrator, having given the test, does not make some constructive use of its results, the test would be better omitted; for only when constructively used are tests worth the time and effort they cost."

The schools of the state of Massachusetts that have physical education courses are training their pupils to administer tests to determine individual health needs, and report results in definite and meaningful terms to pupils, administrators, and parents.

The use of the Rogers' test of physical fitness and strength up to this time has been chiefly in the elementary and high schools for the purpose of grouping. Groups that are composed of pupils of fairly comparable fitness and strength are better and safer for the program of athletic exercises and games.

The Physical Education Department of the Massachusetts State College would like to know whether its Freshman program promotes fitness and strength and this study is made to determine that fact in the terms of the Rogers' test.

1/ Journal of Health and Physical Education, December, 1937

2/ McCloy, C. H. Tests and Measurements in Health and Physical Education - F. S. Crafts and Company, New York, 1939, Chapter I.

Chapter II.

STATEMENT OF THE PROBLEM

The problem facing the investigator was that of gathering data concerning the effect of the required work and of the several team game activities in the freshman physical education program at Massachusetts State College on the strength tests and physical fitness indices.

The main problem immediately suggested secondary problems as follows:

- A. That of determining whether there is an improvement or a declination in the strength and physical fitness index scores of the group as a whole.
- B. That of determining whether there is an improvement or a declination in the strength and physical fitness index scores of the various team game group combinations.
- C. That of determining whether there is an improvement or a declination in the strength and physical fitness index scores in any particular team game group combination.
- D. That of gathering figures to add to the battery of statistics now available, for future reference in relation to the physical fitness index tests with the college age level.

SIMILAR STUDIES IN THIS PARTICULAR FIELD

It is necessary to cite any studies that have been done in the testing field that are similar to this study made at Massachusetts State College. Many studies and their results have been published

on the physical fitness index tests in relation to elementary and secondary schools. The writer could find only one complete study made with the college group. This was a Doctor's dissertation written by Guerdon Norris Messer at New York University, 1932, "Critical Analysis of the Application of the Rogers' Physical Fitness Test to Williams College Students."

This study was made to determine whether the physical fitness test and normal strength indices as established by Frederick Rand Rogers, after experimentation on junior and senior high school boys, were applicable on the college age level for the purpose of grouping students into homogeneous groups for physical education activities. In this study it was also necessary to determine if the results obtained by Rogers could be substantiated in the case of Williams College students; whether the Rogers' normal strength indices could be applied to Williams College students; to determine a more economical and reliable method for the establishment of normal strength indices, on the basis of Williams College data, which would adequately meet the criteria established by Rogers.

Messer found that, while Rogers' Normal Strength Index tables may be reliable for the high school age group with which he worked, they are not valid for the college students examined. New norms were established, known as the Williams College norms, which were established for students on the college age level, and were found to be valid for several reasons. The data gathered in this study showed a high relationship existing between the Strength Index and Physical Fitness Index. It was found, for a rough classification, that the Strength Index could readily be used for the grouping of college students homogeneously for

athletic purposes.

One other study in this particular field of testing that was found by the writer is the "Report on Fall Physical Fitness and Athletic Aptitude Testing at Springfield College". This study was made on the senior and freshman classes in the fall of the 1937-1938 college year by a committee on Medical and Physical Tests at Springfield College, consisting of L. J. Judd, J. D. Brock, W. T. Homes, W. D. Mansfield, P. V. Karpovich, L. A. Larson, E. W. Pennock, P. Stagg, and T. K. Cureton, Jr., Chairman.

The purpose was to rate each senior and freshman on strength fitness and aptitude for all-round athletic ability using Rogers' Strength Index and Physical Fitness Index and Cozens' all-round Athletic Ability Test.

The results were actual scores and percentile ratings for every senior and freshman unless excused because of injury, sickness, or other reasons.

The possible uses stated were:

1. Individuals with very low scores should be referred to the doctor and the physical director for careful general appraisal of health.
2. Since both groups of scores correlate very highly with usual types of major athletic performance, (excepting very specialized and refined skills), the relative capacity of the individuals may be noted and used for:
 - (a) Selecting team material.
 - (b) Classifying class groups as an initial basis.
 - (c) Interesting below average cases in better personal

hygiene and directed physical development and conditioning.

(d) As a basis for evaluating improvement or retrogression at a later time.

(e) A general athletic index apart from or pending other specific types of ability ratings.

3. Possible relationships to academic status and activity choices.
4. Comparisons of individuals with their own class group scores and also with National norms.
5. Comparison of individual's own class groups with performance scores from other institutions and National norms.

QUERIES AND MINOR NOTES

(Journal American Medical Association, May 6, 1939)

The answers here published have been prepared by competent authorities. They do not, however, represent the opinions of any official bodies unless specifically stated in the reply. Anonymous communications and queries on postal cards will not be noticed. Every letter must contain the writer's name and address, but these will be omitted on request.

Physical Fitness Index Tests

To the Editor: What is considered the validity of the physical fitness index tests? In a review of recent strength-testing literature, Frederick Rand Rogers, Ph.D., made the following statement: "The physical educators will be called on more and more to increase pupils' health is revealed by each new report of conditions in the medical field. The plain fact is that physicians, nurses, public health services and hospital organizations are not now keeping abreast of the Nation's health problems, even if they were, they still would only serve 2 to 3 per cent of the population, chiefly preventing these from losing their lives before reaching nature's appointed span. Who is to care for the 30 or 40 per cent whose health is regularly below normal, and steadily slipping down the scale, if not physical educators? and what is health? . . . This is abundantly muscular power and coördination, which are measured most objectively, reliably, economically and interestingly to subjects by the simplest forms of strength tests." Is this a view which physical

educators generally will accept and put into practice? A notice in the Bulletin of the Indiana State Board of Health for October, 1938 was as follows: "Frederick Rand Rogers, director of physical education at Boston University, has written us as follows: 'This is to report that a Boston manufacturing concern, the DuWard Company of 51 Cornhill, Boston, is now experimenting with new designs for physical fitness testing instruments far superior to those now on the market, which they claim they can sell at greatly reduced prices. For example, the new back and leg dynamometer at less than \$100 (the present instrument is listed at \$200 and sold at \$160-\$180). As you know, the chief stumbling block to the use of physical fitness index tests has been the exorbitant cost of dynamometer; therefore we are overjoyed at this new development. This note is a warning; if you know of any one about to order dynamometers, have them wait for the new instruments, or at least until we have a chance to examine and recommend or disapprove them.'" What do you think of this? Finally, I should like to ask what steps the family physician should take when the tests show a low status.

M. D., New York

Answer - (This question has been referred to workers in the field qualified to express opinions on the subject. The answer is based on their combined views.)

This question revolves around the validity of interpreting the degree of muscular strength as a definite reflection of physical fitness. Certainly even though a patient shows high muscular ability in a test it does not follow that his entire physical condition is definitely established. The human body is too complicated to attempt a diagnosis of physical condition by muscular strength alone; furthermore, it is quite generally conceded by students of the subject of physical fitness that performance tests are not as useful and as discriminating in the estimation of physical condition as the non-performance tests. All strength tests are performance tests and hence require the conscientious co-operation of the examinee. In connection with the statement made by Rogers that "the capacity of an individual for work is a useful measure of his health" it may well be asked "What kind of work?" Most individuals today are not called on for great efforts of muscular power. Physical fitness after all is the ability to adjust to the environment and is related quite as much to the countless chemical and physical processes continually taking place as to the ability of muscles to do work.

The physical fitness index test, or the Rogers' test, came into use during the early years of the present vogue for what is called "tests and measurements in physical education." In fact, so widely has this test spread in elementary and in secondary schools that it is being put to the following uses in Brookline, Mass.: (1) as the basis for the physical education activities program prescribed individually for every pupil, (2) as a guide to the evaluation of teaching procedures, (3) as a yardstick against which to consider academic load (the physical fitness index purports to determine not only a child's capacity for physical activity but "to a significant degree also his capacity for mental endurance"), (4) as a criterion by which the nutritional status and health habits may be judged, and (5) apparently as a check on the adequacy of the medical

examination. The school physician is without laboratory facilities, including x-ray examinations, blood tests and determinations of the basal metabolism. The physician presumably therefore misses certain important conditions affecting physical fitness. The impression one gathers is that the physical fitness index is a tool of superior diagnostic value. Armed with this tool the physical educator, "cognizant of all defects," is now being a guide to the doctor, the school nurse, the classroom teacher and the parent (Hines, Thomas H.: A New Emphasis on Health, J. Health and Physical Education, 10:20 (Jan.) 1939). On a priori reasoning alone, the physical education profession must be considered bold indeed to presume serious diagnostic significance inherent in a test administered at the rate of "about a minute per pupil for corps of testers." No physiologist would be willing to say that physical fitness can be judged primarily on the basis of strength, when strength is measured by a battery of tests involving single, maximal efforts. Dynamometer tests are notoriously subject to profound variations from psychic causes alone. Strength probably fluctuates moderately as all biologic functions do. What its normal limits of variation are for the Rogers' strength test has never been satisfactorily studied. No valid test of physical fitness can disregard the inclusion of a direct or indirect estimate of the response of the cardiovascular respiratory system to measured work. If instead of dynamometer tests the Rogers' battery measured the "staying power" of the major big muscle groups, the load, speed, duration and rate of doing work being controlled, its score would have vastly more value. A battery of tests composed of single maximal pulls on a dynamometer certainly does not indicate a child's "capacity for sustained physical activity or endurance."

The following general criticism of the whole test and measurement program prevents taking its results seriously: 1. The instruments used are meticulously calibrated. 2. The technic of the administration of the tests is carefully taught and the reliability of each operator is particularly measured. 3. The subject, however, is handled as a robot, unaffected by meals, fatigue or psychic disturbances. There is no regard for the fundamental rule that in all human research one should begin with a subject in an essentially "basal" condition and then carefully control the environment in which the tests are administered. 4. The data are subjected to involved statistical analyses and the numbers derived uncritically accepted whether there is sense behind the variables being related or not. Statistical methodology has taken the place of reason. 5. There is yet to be seen any evaluation of physical education fitness tests in a physiologic sense or any discussion of the possible mechanism whereby defects (the wen with the cancer beneath it) may be logically thought to modify physical fitness.

It may be safely concluded that current scientific opinion cannot grant that physical fitness can be deduced from one set of measurements alone or that muscular strength is either an accurate or a valuable index of physical fitness. (If it were, why is it that women at practically all ages have a longer life expectancy than men?) The skeletal muscle might be in good shape while there was difficulty impending in the smoother muscle of the viscera. Of all measurements, those of muscle might be considered the poorest. Emotional states determine their energy

output in a large measure, and this is a serious objection. Positive performance tests are notoriously hard to control. Devotion to one test and the advice that all others be discarded for experimental purposes when associated with advertisements for \$100 dynamometers do not lend credence to the scientific nature of the studies reported.

Chapter III.

THE BROAD LIMITATIONS OF THE PROBLEM AND PROCEDURE

The subjects chosen for testing in this study were the men of the freshman class that entered Massachusetts State College in September of 1938. Through conference with the college physician and head of the Department of Physical Education for Men, it was found that this class represented a typical Massachusetts State College freshman group according to structural development. Massachusetts State is not a physical education college. There is, therefore, represented a varied group of men according to body build and physical make up. Boys from rural as well as urban home environment; boys with little or no previous athletic experience and those with a great deal of athletic experience; some that have worked for a livelihood and those that have not had to work; are all represented in this group. There is nothing atypical about the group used for testing in this study.

Ideal testing conditions existed for the administration of the tests for this study. Adequate facilities, such as equipment and place for testing were available. The test administrators were competent men from the Department of Physical Education that had had previous experience in this type of work and were thoroughly familiar with the use of the apparatus and the correct methods of measurement.

It was necessary to eliminate a comparatively few members of the class from the strength tests due to various physical defects which would not only limit the performance of the individual, but also prove dangerous to him had he been allowed to go on and take the tests. Individuals with structural defects that limited their activity and those

that had strains or recent operations were the only ones eliminated from the tests. Only a few men were exempted by the physician. Some of them had defects as a result of infantile paralysis, one had previously suffered a cerebral hemorrhage while taking the strength tests in high school, and some exhibited green scars from recent operations. The remaining furnished a varied, yet selected group to be tested.

There are certain uncontrollable factors that may enter into this study that may cause an improvement or a dropping off in the test results that cannot be considered. This study is based upon physical and strength improvement and it is therefore necessary to eliminate any other possible contributing factors that may be a cause for change but that cannot be measured according to the tests given. No attempt has been made to pry into the everyday habits or living conditions such as diet, rest hours, or physical activity other than the everyday physical program that each student gets through attending the required physical education program here at Massachusetts State College.

To secure as accurate a picture as possible of what was happening in the Physical Education program, it was necessary to give the same tests to the same people at the beginning of College in September, 1938, and as near the end of the year as possible, April, 1939.

Due to factors that could not be controlled by the writer, a small number of the group selected for testing failed to repeat the tests. It was therefore necessary to eliminate this small number of the group and carry on the study with the remaining students. These, however, furnished a representative majority of the class to study.

Chapter IV.

PRELIMINARY TESTS

The freshman class entering Massachusetts State College in 1938 was the first class in some time to be given any form of physical measurement other than the usual medical examination by the college doctor. Physical achievement tests prescribed and administered by the Department of Physical Education have also been given. Acting in co-operation with the State Department of Physical Education to do some experimenting with the college age level, the physical fitness index tests were administered by the Department of Physical Education for Men to all freshmen. A required medical examination for entrance into the institution is a prerequisite.

The medical examination, as prescribed by the head of the student health department, Dr. Ernest J. Radcliffe, is required of all students entering Massachusetts State College. This medical examination is complete in every detail to insure the college of healthy students that are not handicapped physically. The examination is given by Dr. Radcliffe, and assisted by graduate medical students which thoroughly verifies the validity of the test results.

The following physical examination record blank shows the content of the test given:

MASSACHUSETTS STATE COLLEGE
PHYSICAL EDUCATION DEPARTMENT

Visible Records Equipment Co., Chicago Flex-Site Health Form 14323 A Rev.

[illegible]

Yearly, lung x-rays are also administered by this department in connection with the medical examination. Each student has a record which includes his entire medical history at college. These records are filed and used for reference from time to time.

A certificate for physical fitness, signed by the college doctor, for any team game activity, whether it be intramural or varsity, is required from every man before he is allowed to participate in this activity. In this way, the Department of Physical Education is assured that no man is taking part in an activity that he is not physically able to participate in.

Due to the fact that the physical fitness index tests are in themselves a form of physical activity, the requirement for certificate from the college doctor was necessary for each individual previous to being tested.

The Rogers' physical fitness tests were introduced into the freshman physical education program at Massachusetts State College this year in order that this program of recreational and big muscle activities might be measured on some basis. It is the desire of the Department of Physical Education for Men to study their program in terms of Rogers' physical fitness index and strength tests insofar as it is possible to make any comparisons or gather data concerning the effect of their program on the strength and physical fitness indices of the students.

Chapter V.

THE ROGERS' PHYSICAL FITNESS INDEX TESTS

"Before proceeding with a description of the Physical Fitness Tests it might be well to state that the motivating force behind Rogers' research was the desire to evolve a suitable test for homogeneous grouping of students for physical education activities. Probably the greatest contribution that had been made in this field of educational work was that of Dudley Allen Sargent when he evolved the Harvard Strength Tests, which were used by him for years at that institution. W. G. Anderson of Yale, Joseph E. Raycroft of Princeton, and R. Tait McKenzie of Pennsylvania all worked long and arduously in the early dates of anthropometric measurements, using the Sargent tests as a basis, and were able to substantiate many of the results claimed by Sargent. The events used by Rogers in his tests were not new, but were re-grouped from the Sargent Strength Tests in an endeavor to adapt them to 'the modern school program which attempts to meet the needs of individuals and utilize psychologically sound methods of teaching.'¹ The clever creation and manipulation of Strength Index norms is a distinct feature which can be attributed to Rogers."²

In 1911, Frederick Rand Rogers had his first experience with these tests at Exeter Academy and in 1920, first used them in a high school in California to measure athletic ability and the physical progress of pupils in high schools of that community.

-
1. Rogers, Frederick Rand, Tests and Measurement Programs in The Re-direction of Physical Education, Teachers College, Columbia University, New York City, p. ix.
 2. Messer, Guerdon Norrs, Critical Analysis of the Application of the Rogers Physical Fitness Tests to Williams College Students, School of Education, New York University, p 12.

In 1923, Rogers began to give these tests in his work on a doctor's dissertation at Columbia University. In 1925, he wrote a dissertation "Physical Capacity Tests".

Since 1926 these tests have been used in New York State and have been practically an official testing technique in the state since 1927. They were formerly incorporated in the State Syllabus, printed in 1923. Since 1928 experimentation using the tests have been carried on increasingly in many schools and colleges throughout the nation.

"Rogers supports the tests as a measure of fitness because: A logical deduction will serve to indicate the significance of the strength tests as measures of general physical fitness:

1. Since large muscle activity improves general fitness, and
2. Since large muscle activity affects the strength of the active muscles, therefore
3. A measure of the strength status of muscle fibers is also a measure of the fitness status of the vital organs which determine the health of the body."¹

The procedure for administering the physical fitness index tests and the tests and apparatus is as follows:

Age (years and months)	----
Weight (pounds)	Scales
Height (feet and inches)	Stadiometer
Pullups (number of times)	Wall bars
Pushups (number of times)	Parallel bars
Lift-legs (pounds)	Back and leg dynamometer
Lift-back (pounds)	Same
Grip-left (pounds)	Hand dynamometer
Grip-right (pounds)	Same
Lung capacity (cu. in.)	Wet spirometer and individual mouth pieces

1. Glassow, Ruth B. and Broer, Marion R. Measuring Achievement in Physical Education, W. B. Saunders Co., 1938, p. 272

M.S.C. Dept. of Physical Education
for Men

Date
m
d
y

Name

Grade

Age

Weight

Height

$\left(\frac{\text{Wt.}}{10} + \text{Ht.} - 60\right)$

* Multiplier

Pullups

Pushups

Lift back

Arm Strength

Lift-legs

Grip-Left

Grip-Right

Lung capacity

STRENGTH INDEX

Normal S. I.

PHYS. FITNESS
INDEX

Classification

Accuracy in giving the tests is important. Considerable practice is necessary in order to reduce errors and make the testing procedure uniform. It is recommended to use a Physical Record Card.

*The multiplier is determined by adding one-tenth of the weight to the height minus 60. $(\frac{wt.}{10} + hgt. - 60)$ and the "arm strength" is found by multiplying this sum by the sum of the pullups and pushups.

$$(\frac{wt.}{10} + hgt. - 60) \times (\text{pullups} + \text{pushups}).$$

This "arm strength" is then added to the other scores "leg-lift", "back-lift", "grips" left and right, and "lung capacity", and the total is the Strength Index for the individual tested. This total is then entered opposite "Strength Index" on the record card.

Next, refer to the table of norms, and enter on the record card, opposite "Normal Strength Index", the normal strength index for the individual's age and weight.

The Physical Fitness Index (P.F.I.) is found by dividing the individual's achieved Strength Index by the normal strength index for his age and weight.

Chapter VI.

THE PHYSICAL FITNESS TESTS AS GIVEN AT MASSACHUSETTS STATE COLLEGE

Massachusetts State College Physical Education Program

Before attempting to go further into the actual tests and test results, the writer feels that it is necessary to introduce and carefully explain the Physical Education program that is carried on for freshmen at Massachusetts State College, as it is this program that is being used for the study and the possible effects of this program on the strength and physical fitness indices.

This program is unique in itself, in that it furnishes variety in activity, stressing interest more than full time participation, so that the student may select that particular activity or group of activities, each in its respective season, and become thoroughly acquainted with it. The ultimate idea is that later on in life, the choice of an activity that is made at this time will be of use to the student during his leisure and satisfy his desire for exercise. The Department of Physical Education for Men at Massachusetts State College has taken the name of "Carry Over Value" for this program. This type of program eliminates the cut and dried type program in which students often find themselves, whereby they avoid participation in any supervised physical activity.

The major sports of today are not in any way eliminated or interfered with in this program. They also are required of all students. Each student makes his choice of any sport, in its season, that he is interested in and follows this sport through as a "team game activity" under a coach who furnishes instruction and supervision during a regular season schedule.

Massachusetts State College also carries on a very extensive intramural athletic program which is explained in detail later in this chapter. This program is of a purely elective type and furnishes competitive athletics for those students not qualified for varsity competition.

Social Sports at Massachusetts State College

The place of the College is to provide not only training and many experiences to help the individual acquire a livelihood, but also to build up a repertoire of interests and practices for the rightful occupation of leisure time.

Professor William James has emphasized the importance of the mind and body reactions or habits. Approximately 97% of our self expression may be considered as reflexes or habits and only 3% of the things that we do are deliberations of the will. If this is true, our habits are of outstanding importance in determining the success of our lives and are of added importance in supporting us in the exercise of our wills.

Many people stop playing because they grow old. Undoubtedly they grow old because they stop playing.

What does Physical Education here at State College offer?

1. There are offered possible improvements in health by encouraging personal participation in wholesome big muscle activity. Athletic sports and games, dancing, rhythms, swimming and similar activities influence the body functions, stimulate and satisfy bodily muscle hunger. These activities improve strength, endurance and vitality.

2. It teaches many individual skills in a variety of activities which can be used while growing. With this in mind, the required program for Freshman Physical Education offers an opportunity for individuals

to elect a variety of team game activities such as soccer, football, basketball, baseball, etc., which are based upon instruction in skills as a means of physical development and of building muscle coördination during the formative years.

3. The Department also offers a wide variety of activities of carry-over value for recreation during middle life. These include such activities as archery, golf, tennis, swimming, volleyball, and badminton. Participation in these activities is required, not solely because of their importance as a recreational opportunity for middle life, but because of their value as a means of teaching social efficiency. Confidence which comes from self-mastery from acquired skills in physical activity helps to overcome inferiority complexes and self-consciousness. Thousands of individuals crave the skill necessary to allow them to take their places as equals in golf, tennis, swimming, badminton and other sports. The Physical Education Department accepts this challenge and with sympathetic and competent instruction endeavors to equip individuals to become competent in a variety of carry-over or social skills.

4. An ideal program should offer instruction and opportunity for participation in activities desired by the students. By means of a questionnaire to the freshmen men, the following statistics were derived, showing the number having experience previous to entrance, number desiring to continue participation, the number with no experience that want instruction, number desiring instruction and the percentage desiring instruction in the various listed activities:

Department of Physical Education for Men
Freshman Physical Activity Survey
October, 1938

Class Registration.....										236
	# having experi- ence pre- vious to entrance	Rank	# desir- ing to continue partici- pation	Rank	# with no exper- ience Want in- struction	Rank	# desir- ing in- struction	Rank	% desir- ing in- struction	
Swimming	86	2	45	3	87	3	132	1	56%	
Skiing	25		14		101	1	115	2	48%	
Riding	16		9		88	2	97	3	41%	
Football	82	4	49	1	40		89	4	38%	
Golf	25		11		69	5	80	5	34%	
Skating	53	6	16	10	64	6	80	5	34%	
Fencing	5		3		76	4	79	7	33%	
Basketball	92	1	46	2	30		76	8	32%	
Life Saving	38		17	9	58	10	75	9	32%	
Diving	19		12		62	8	74	10	31%	
Archery	11		6		64	6	70	11	30%	
Baseball	85	3	44	4	26		70	11	30%	
Hunting	28		23	7	45		68	13	29%	
Boxing	8		5		60	9	65	14	27%	
Tennis	20		10		51		61	15	25%	
Canoeing	42	9	13		48		61	15	25%	
Fishing	41	10	24	6	37		61	15	25%	
Track	54	5	26	5	35		61	15	25%	
Badminton	10		4		56		60	19	25%	
Sailing	21		8		49		57	20	24%	
Soccer	23		9		42		51	21	21%	
Hockey	31		13		38		51	21	21%	
Rowing	49	7	11		34		45	23	19%	
Softball	29		10		34		44	24	19%	
Touch football	37		10		34		44	24	19%	
Volleyball	42	9	18	8	26		44	24	19%	
Hiking	43	8	14		20		34	27	14%	
Snowshoeing	5		0		30		30	28	12%	
Wrestling	5		3		26		29	29	12%	
Handball	17		8		21		29	29	12%	
Gymnastics	27		6		22		28	31	11%	
Squash	2		0		24		24	32	10%	
Cross-country	5		2		19		21	33	9%	
Lacrosse	4		3		12		15	34	6%	

Fall elections in five major sports

	1937-38	1938-39
Football	32%	40%
Swimming	21%	26%
Soccer	14%	14%
Fall Track	14%	6%
Cross Country	10%	5%

Number of Non-Swimmers	12	13
Recommended for remedial gymnastics	5	0
Average age	18 yrs. 7 mo.	18 yrs.
Average height	5' 8.87"	5' 7"
Average weight	146½ lbs.	142 lbs.

The required Physical Education course for freshmen, as taken from the Massachusetts State College Bulletin, specifies one hour a week of exposure to carry-over value and life-time sport instruction. The development of recreational aptitudes is stressed. Team game participation is required. Men will elect two seasonal athletic activities per semester or their equivalent. Special work is required for those freshmen whose physical examinations show that postural corrective work is indicated.

The following unit plan shows the type of program carried on in the required, one hour sections:

Massachusetts State College

Physical Education

Unit Plan

October	3 - 8	Physical Fitness Index Tests
	10 - 15	Physical Achievement Tests
	17 - 22	Swimming Test
	24 - 29	Touch football
	31 - Nov. 5	Archery
November	7 - 12	Archery
	14 - 19	Archery
	21 - 22	Badminton
	23 - Dec. 3	Badminton
December	5 - 10	Badminton
	12 - 17	Skiing
January	4 - 7	Skiing
	9 - 14	Skiing
	16 - 21	Volleyball
February	6 - 11	Volleyball
	13 - 18	Volleyball
	20 - 25	Swimming
	27 - Mar. 2	Swimming
March	5 - 10	Swimming
	12 - 17	Life Saving
	19 - 24	Canoe-safety
	26 - Apr. 1	Canoeing
April	10 - 15	Fishing (Fly-bait casting)
	17 - 22	Physical Fitness Index Tests

April	23 - 28	Softball
	30 - May 5	Softball
May	7 - 12	Golf - Tennis
	14 - 19	Golf - Tennis
	21 - 26	Golf - Tennis

The various team game activities that are available for electives in connection with the required physical education program are divided into groups, according to their prospective seasons. These consist of the two hour periods and meet twice weekly. A student must elect one sport from each of the following groups or two sports per semester.

Team Game Participation Electives

First Semester

<u>First half</u>	<u>Second half</u>
Football	Basketball
Soccer	Boxing
Swimming	Swimming
Fall Track	Winter Track
Cross Country	Wrestling
	Winter Sports
	Hockey

Second Semester

<u>First half</u>	<u>Second half</u>
Basketball	Baseball
Boxing	Spring Soccer
Swimming	Spring Football
Winter Track	Track
Wrestling	Swimming
Winter Sports	
Hockey	

INTRAMURAL ATHLETICS

Due to the rules for eligibility in the State College intramural athletics, there are a great many freshman students in the intramural leagues. The intramural athletic program is run in the form of interfraternity competition.

The aim of intramural sports is to afford the opportunity for every student in the College to build up a repertoire of wholesome recreational habits through athletic competitions. A small percentage of the students constitutes the varsity squad in any one sport; nevertheless, the opportunity for the less skilled student to get in the game is presented through the medium of intramural sports. Each competitor is urged to acquaint himself with the program and make an effort to compete in at least one sport during the year. The program is presented for the purpose of supplying the student with enjoyable physical recreation.

It must be kept in mind that the primary objective of the athletic program is to afford competitions for those men who are unable to make varsity teams. Varsity athletics care for the skilled men while intramurals meet the needs of those who are less skilled.

Men who are on varsity squads during any one of the three terms (fall, winter, or spring) or have been awarded a varsity "M" will be ineligible for competition on any intramural team for that term. These squad men are receiving an opportunity for physical activity and if they are permitted to compete in intramurals they will be depriving the less skilled man of his only opportunity for such activity which is offered him through the medium of intramural sports. A varsity squad is defined as those men who are survived the varsity cuts and

whose names appear on the attendance record book of that particular sport.

The sports offered for intramural competition are listed as follows: Fall Term: Touch football and soccer; Winter term: Basketball and Volleyball; Spring term: Track and Baseball (softball).

Introduction to Statistics Obtained
in the Study

The following graphs were made from the results obtained by administering the Physical Fitness Index test to 149 men taking the Physical Education course at Massachusetts State College.

The test was first administered in September, 1938, before any classes were attended. The second test was administered in April, 1939, following the winter sport season in the program.

The three team game group combinations used for the study consisted of scores obtained from men that engaged in the same combination of team games. That is, all men engaged in football and basketball were placed in one group, those engaged in swimming for both sport seasons were listed in another group, and those engaged in track for both seasons were placed in the third group. It was necessary to limit the study to these three groups due to insufficient number of cases in any of the other various team game groups.

The statistics in the strength and Physical Fitness Index tests of the three team game group combinations listed above, and the group as a whole are used to make the following graphs.

The panel at the base of Graph I. shows the distribution of all participants in the September, 1938, Physical Fitness Index tests; Graph II., the participants in the April, 1939, Physical Fitness Index tests; Graph III. comparison showing gain in the two test scores received in the Physical Fitness Index tests.

Graph I. shows the results of the Physical Fitness Index scores taken of the entire group (149 cases) in September, 1938, showing the

mean (71.68), standard deviation (15.45), median (67) and range of 35-120 or 85.

Graph II. shows the April, 1939, scores; it is found that the mean is 75.15 (an increase of 3.47), the standard deviation is 14.29 (showing a more reliable mean). This is further verified by the median (74.75) which is not effected so much by extreme cases. The range has moved up to 40-125 or 85, which, with an increase of 7175 in the median, shows some improvement has taken place in the Physical Fitnexx Index scores of the different men.

Summary of Results:

Median Physical Fitness Index Scores of Whole Group

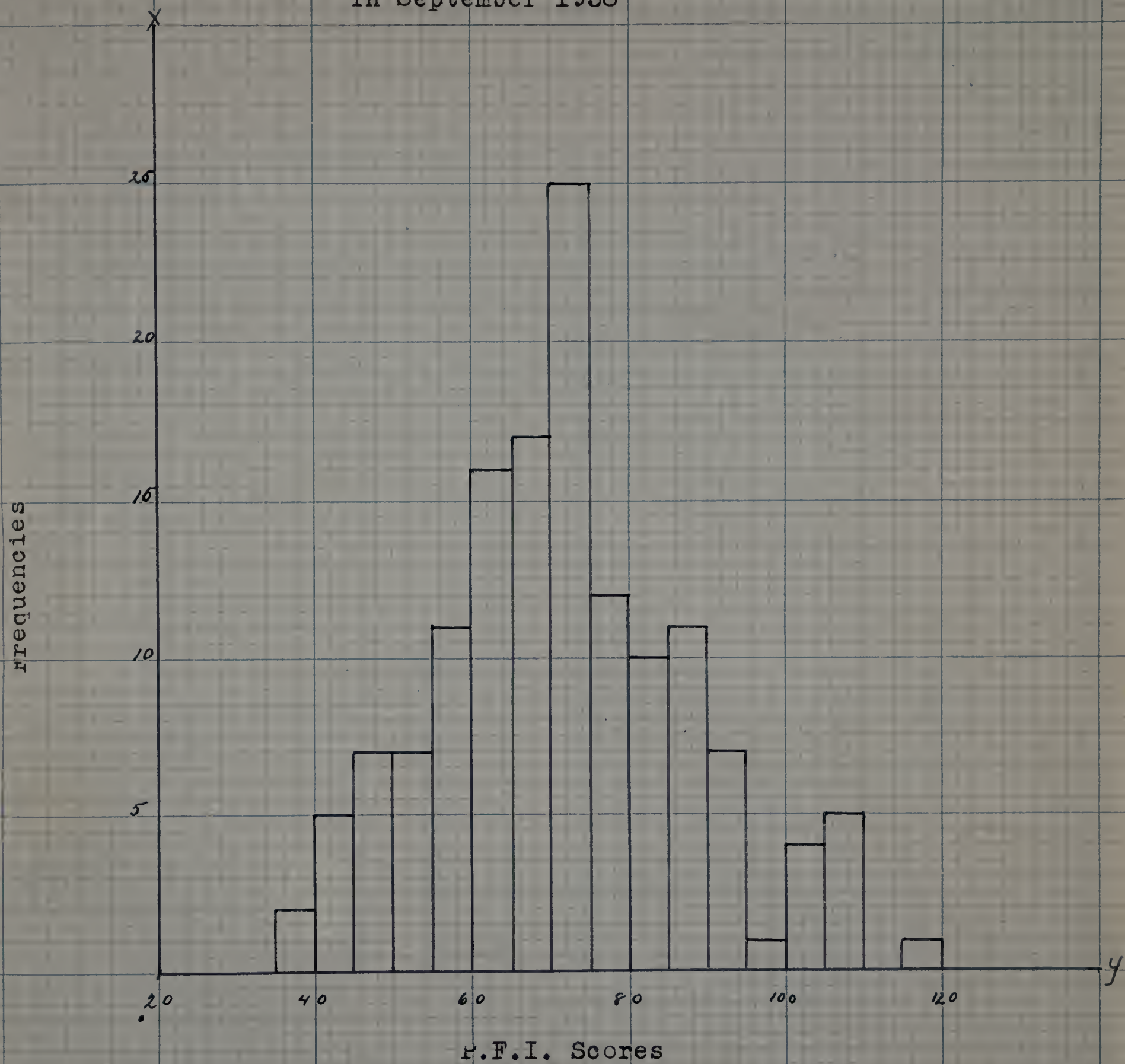
September, 1938	67
April, 1939	<u>74.75</u>
Gain	7.75

Results:

The above scores indicate that there has been a gain of 7.75 in the median and 3.47 in the mean.

-28-
GRAPH I

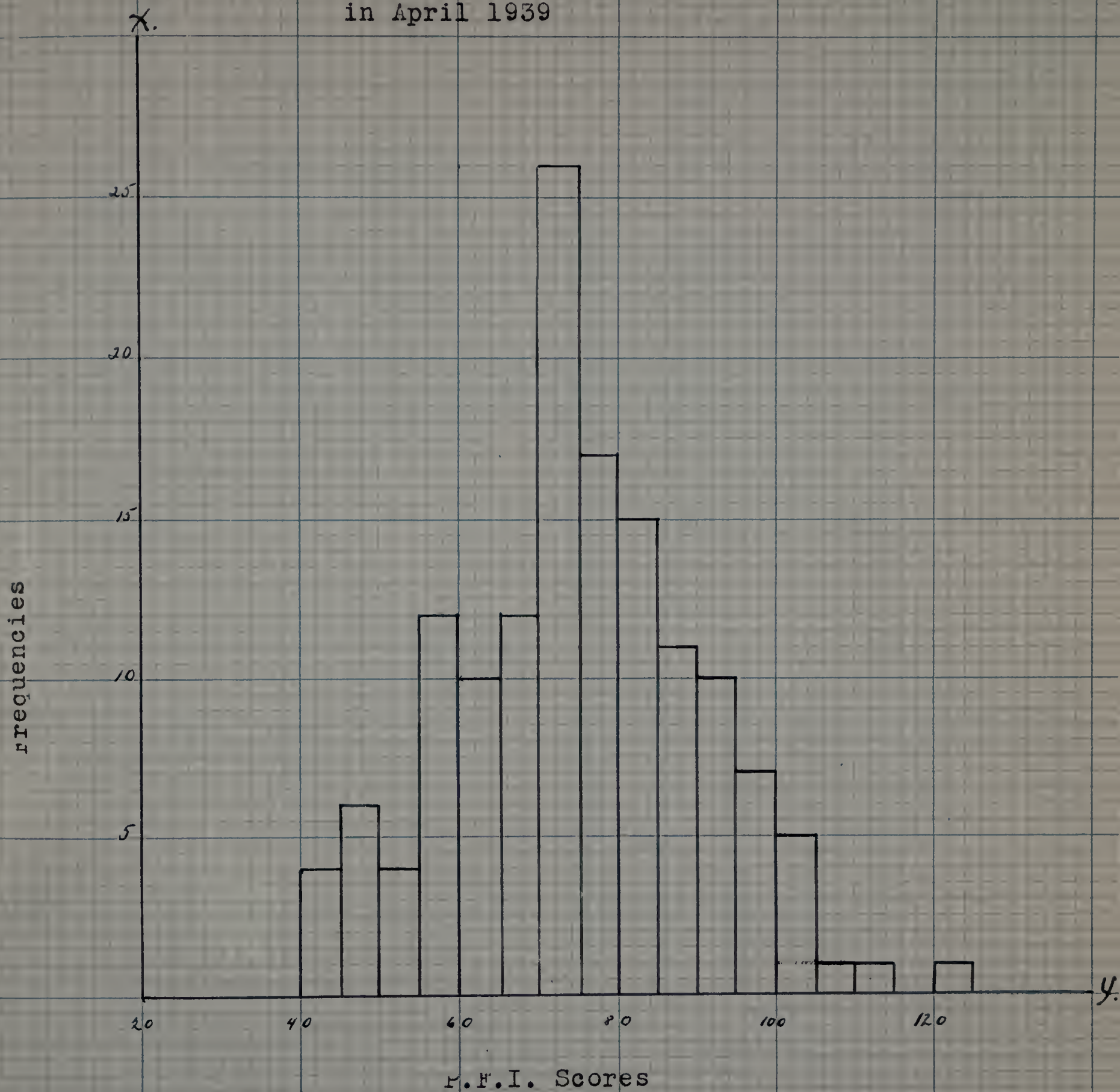
frequency rectangles of P.F.I. Scores taken
at Mass. State College
in September 1938



Mean---71.68
Standard Deviation of the mean-15.45
Median--67

GRAPH II

Frequency Rectangles of P.F.I. Scores taken
at Mass. State College
in April 1939



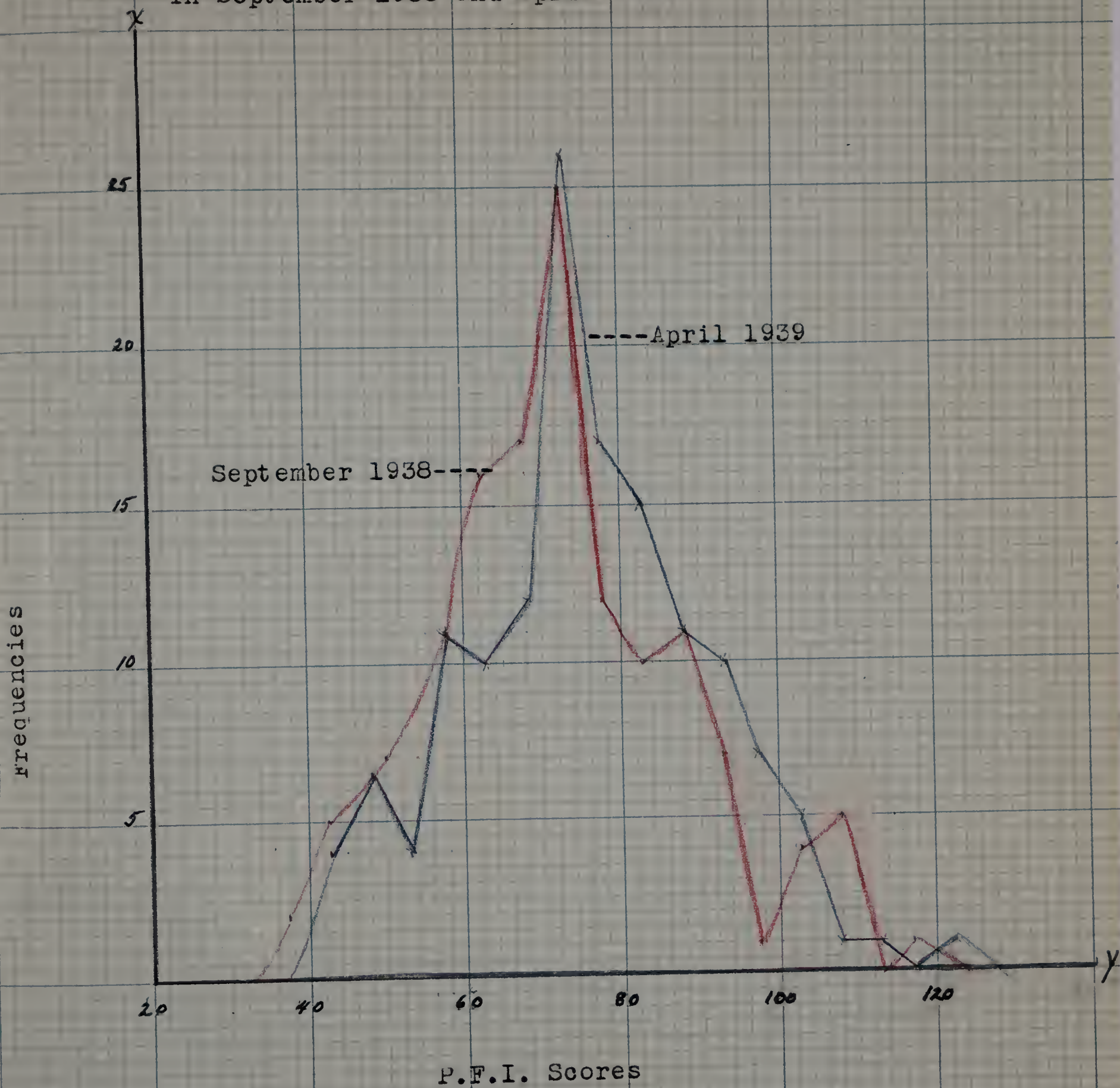
Mean--75.15

Standard Deviation of the mean-14.29

Median--74.75

-30-
GRAPH III

Frequency Polygon of P.F.I. Scores taken
at Mass. State College
in September 1938 and April 1939



The panel at the base of Graph IV. shows the distribution of all participants in the September, 1938, Strength Index tests; Graph V., the participants in April, 1939, Strength Index tests; Graph III., comparison showing gain in the two test scores received in the Strength Index tests.

Graph IV. shows the result of Strength Indices taken of the entire group (149 cases) in September, 1938, which indicates the mean (1337.3), standard deviation (161.56), median (1255.88), and range of 600-2200, or 1600.

Graph V. shows the April, 1939, scores, is found that the mean is 1537.23 (an increase of 199.93), the standard deviation of 248. The median is 1447.82 and very close to the mean showing that the mean is reliable as the median is not effected so much by the extreme cases. The range has moved up to 700-2400, or 1700, which with the mean shows some improvement has taken place in the Strength Indices of the different men.

Graph VI. shows Strength Index distribution, the April, 1939, superimposed over the September 1938 indices. This clarifies former remarks as to improvement of the Strength Indices.

Summary of Results:

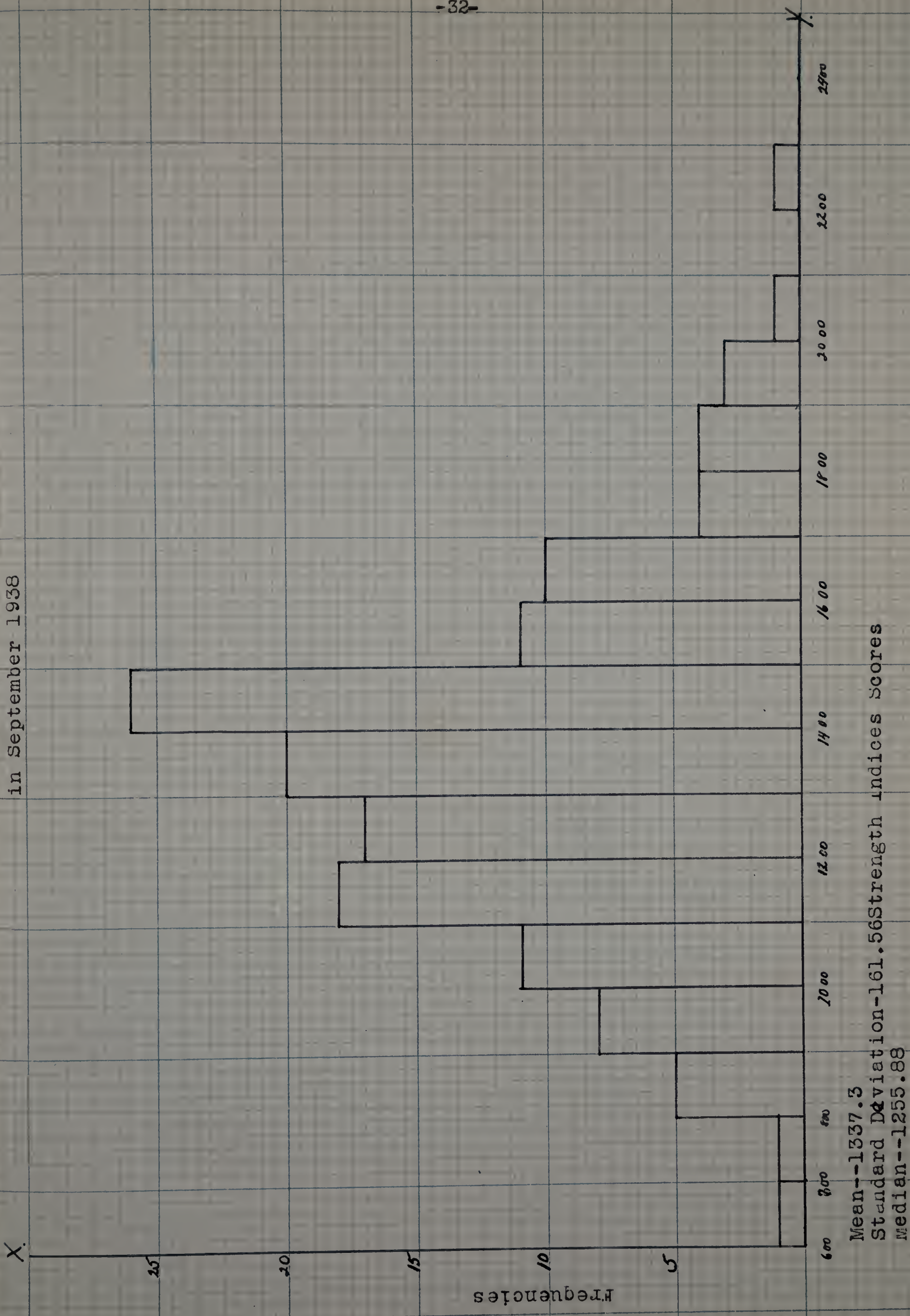
Median Strength Index Scores of Whole Group

September, 1938	1255.88
April, 1939	<u>1447.22</u>
Gain	191.34

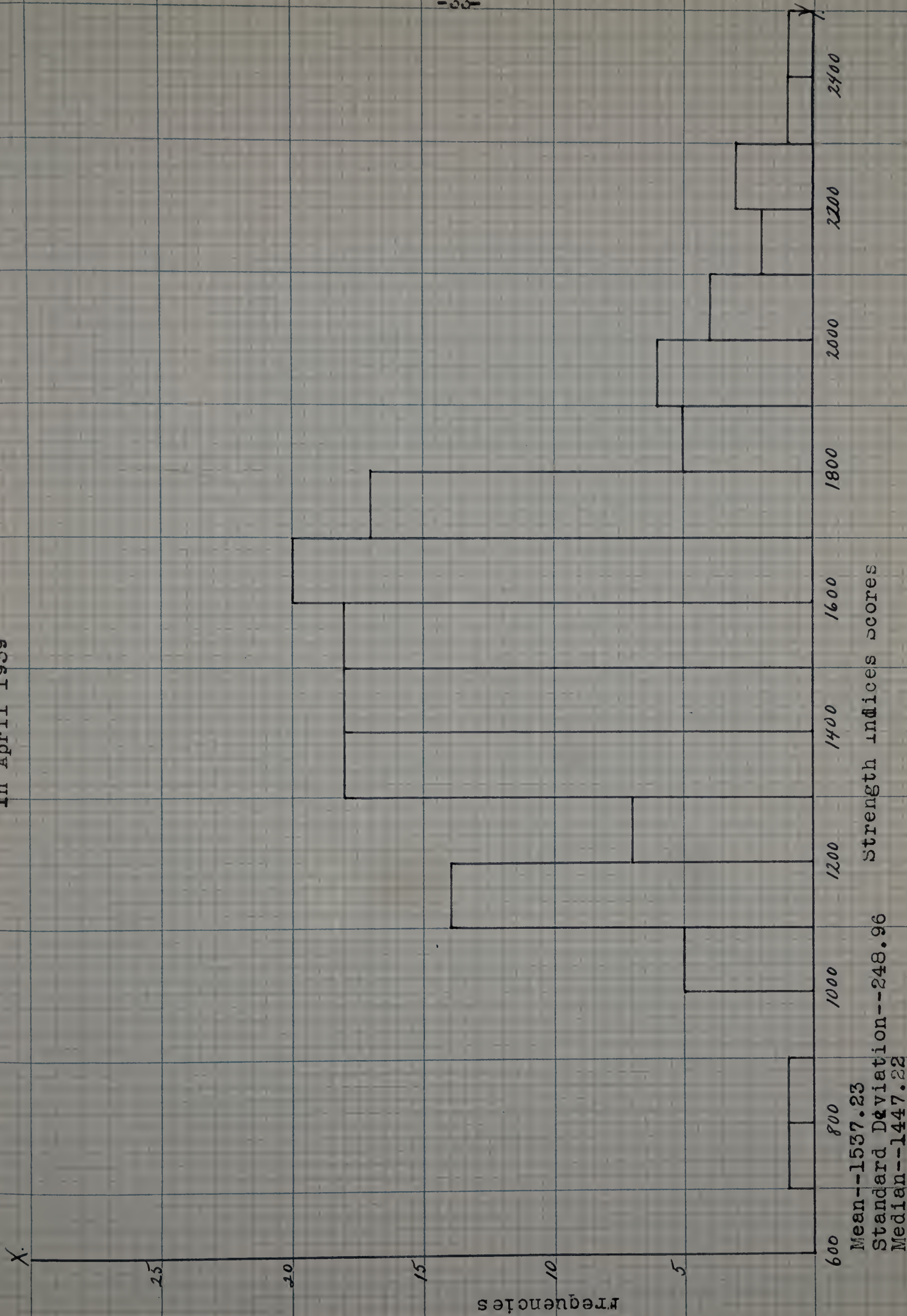
Results:

The above scores indicate that there has been a gain of 191.34 in the median and 199.93 in the mean.

at Mass. State College
in September 1938



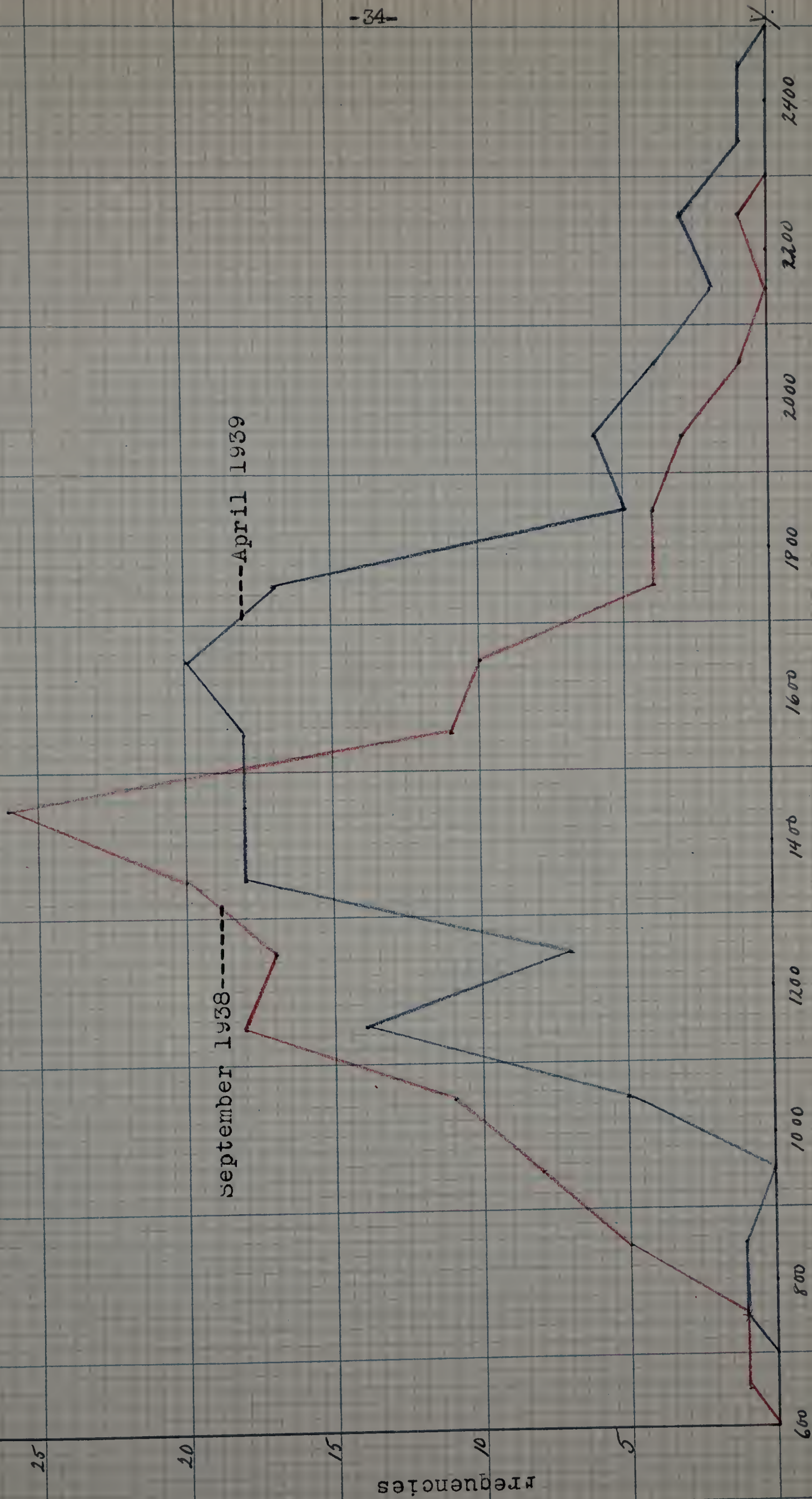
in April 1939



at Mass. State College

in September 1938 and April 1939

X.



The panel at the base of Graph VII. shows the distribution of the football-basketball group in the September, 1938, Physical Fitness Index tests; Graph VIII., the same group in April, 1939 Physical Fitness tests; Graph IX. comparison showing gain in the two test scores received in the Physical Fitness Index test.

Graph VII. shows the result of Physical Fitness Index scores taken of the football-basketball group (21 cases) in September, 1938, showing the mean (62.97), standard deviation (8.25), median (58.07), and range of 45-75.

Graph VIII. shows the April, 1939, scores, is found that the mean is 67.5 (an increase of 4.6), the standard deviation of 9.85. The median is 63.33. The range has moved up 45-80, which with the mean shows some improvement has taken place in the Physical Fitness Index of this group.

Graph IX. shows Physical Fitness Index distribution, the April, 1939, superimposed over the September, 1938, scores. This clarifies former remarks as to improvement of the scores for this group.

Summary of Results:

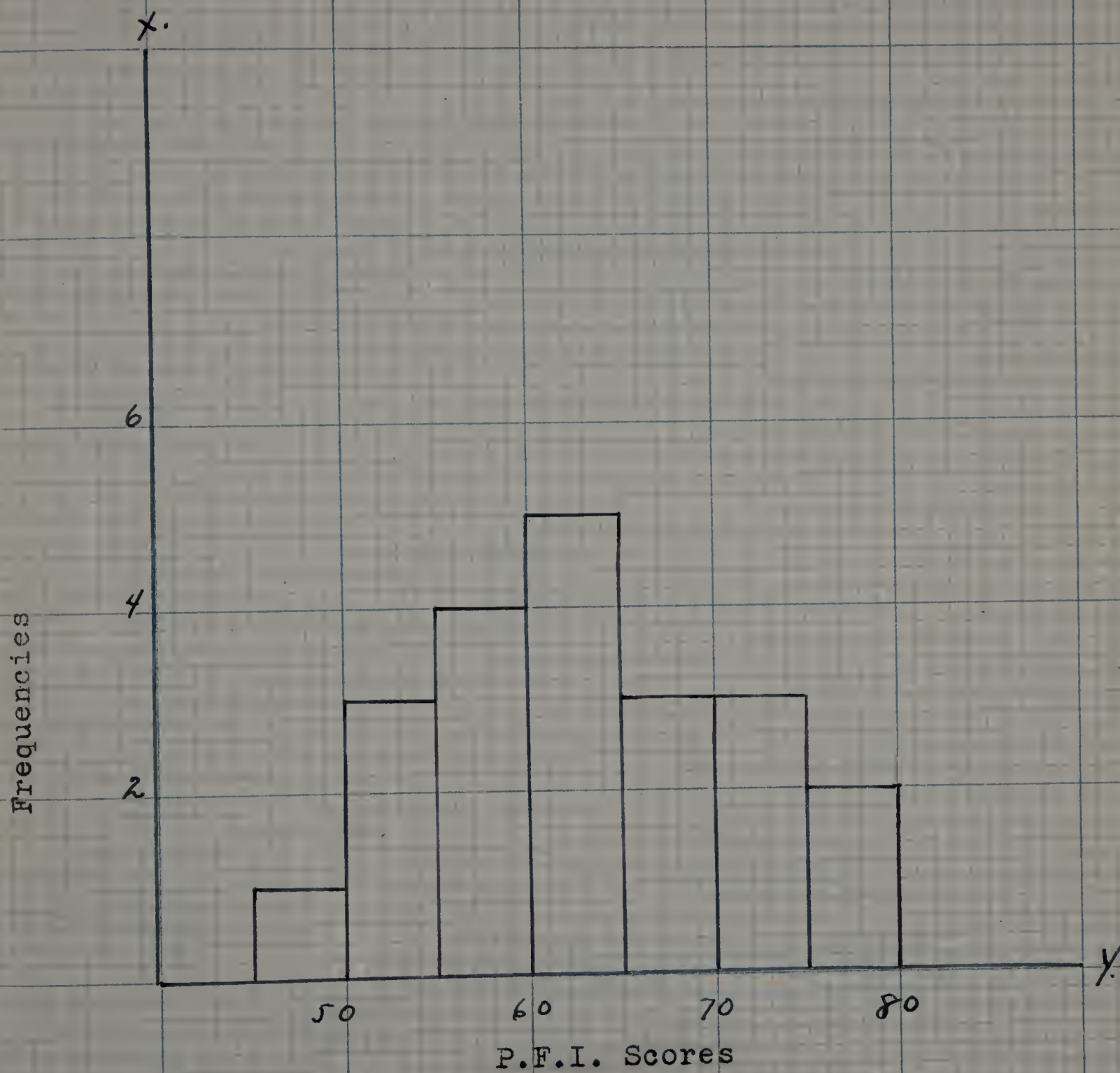
Median Physical Fitness Index Scores of Football-Basketball Group

September, 1938	58.07
April, 1939	<u>63.33</u>
Gain	2.26

Results:

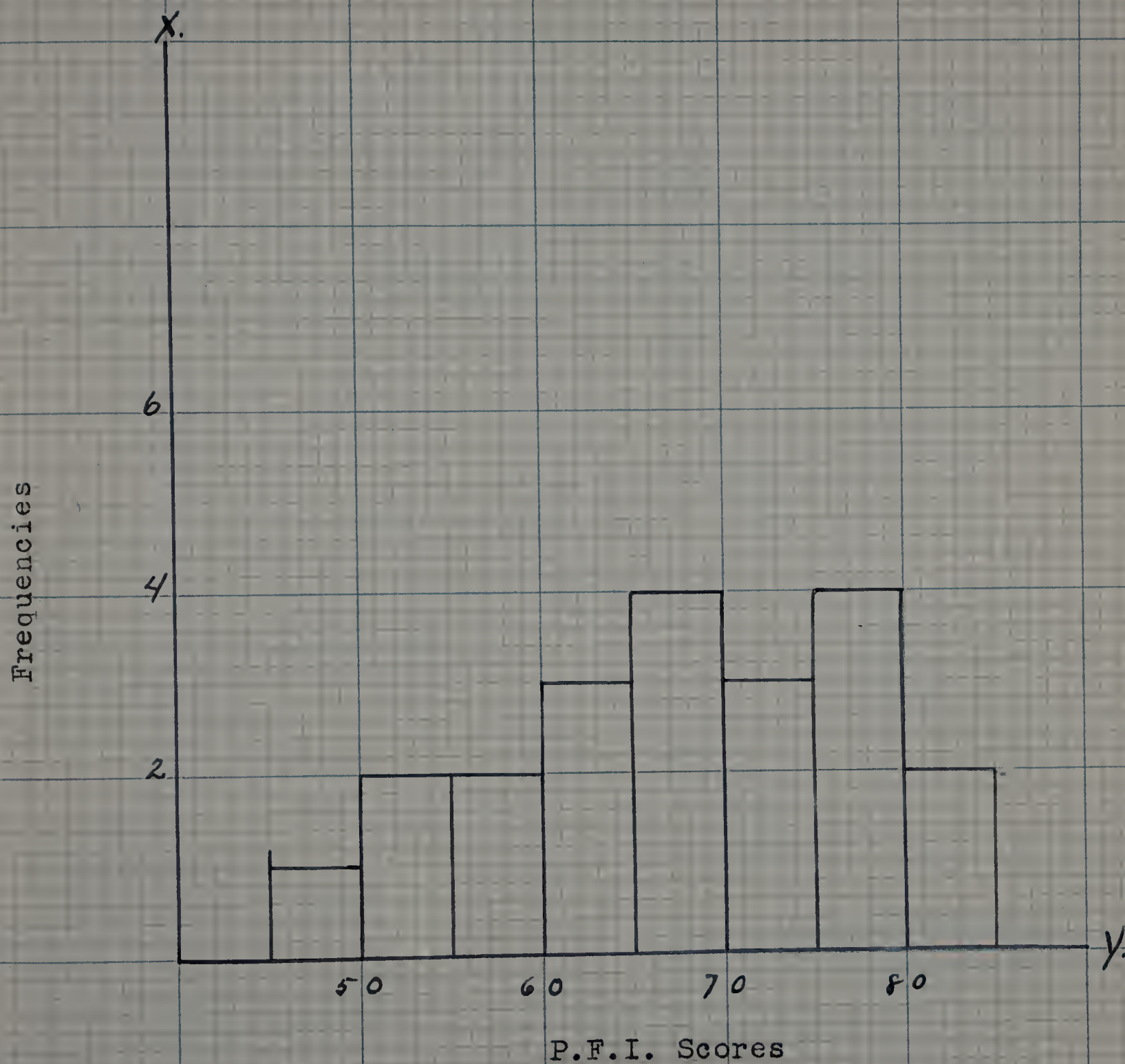
The above scores indicate that there has been a gain of 2.26 in the median and 4.6 in the mean.

Frequency Rectangles of P.F.I. scores taken
at Mass. State College
in September 1938
(Football-basketball Group)



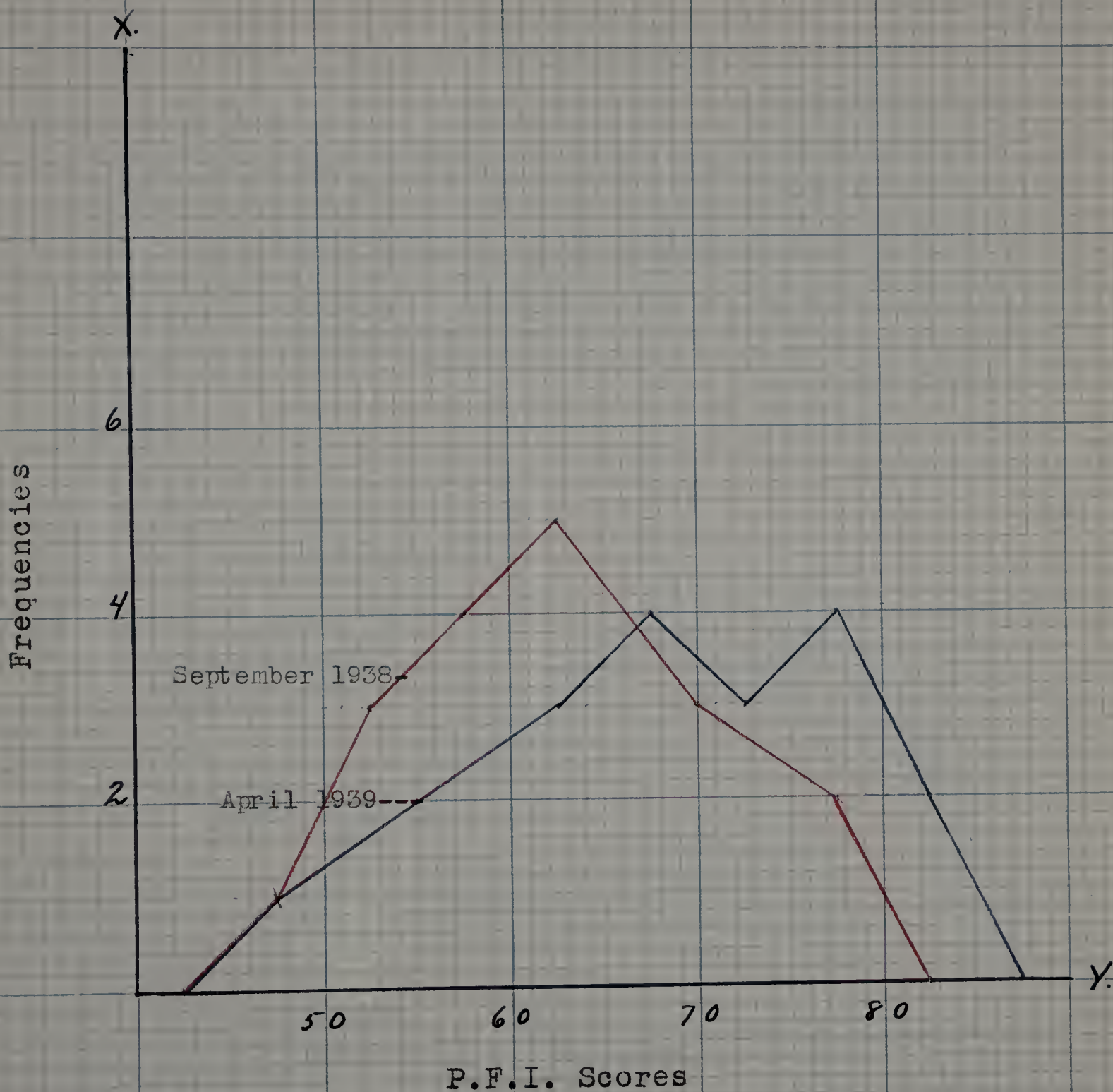
Mean--62.97
Standard Deviation--8.25
Median--58.07

Frequency Rectangles of P.F.I. scores taken
at Mass. State College
in April 1939
(Football-basketball Group)



Mean--67.5
Standard Deviation--9.85
Median--63.33

Frequency Polygon of P.F.I. Scores taken
at Mass. State College
in September 1938 and April 1939
(Football-basketball Group)



The panel at the base of Graph X. shows the distribution of the Football-basketball group in the September, 1938, Strength Index tests; Graph XI., the same group in April, 1939, Strength Index tests; Graph XII., comparison showing gain in the two test scores received in the Strength Index test.

Graph X. shows the result of Strength Indices taken of the football-basketball group (21 cases) in September, 1938, showing the mean (1321.42), standard deviation (195), median 1200, and range 900-1800.

In Graph XI. showing the April, 1939, indices, it is found that the mean is 1573.8 (an increase of 252.4), the standard deviation of 248. The median is 1320. The range has moved up 1000-2400, which with the increase in the mean shows some improvement has taken place in the strength indices of this group.

Graph XII. shows strength index distribution, the April, 1939, superimposed over the September, 1938, indices. This clarifies former remarks as to improvement of the scores for this group.

Summary of Results:

Median Strength Index Scores of Football-basketball Group

September, 1938	1200
April, 1939	<u>1320</u>
Gain	120

Results:

The above scores indicate that there has been a gain of 120 in the median and 252.4 in the mean.

at Mass. State College

in September 1938

(Football - basketball Group)

x

6

Frequencies

4

2

960

1100

1300

1500

1700

1900

2100

2300

2500

y

Strength Indices

Mean--1321.42

Standard Deviation--195

Median--1200

at Mass. State College

in April 1939

(Football-basketball Group)

X

6

4

2

Frequencies

-41-

900

1100

1300

1500

1700

1900

2100

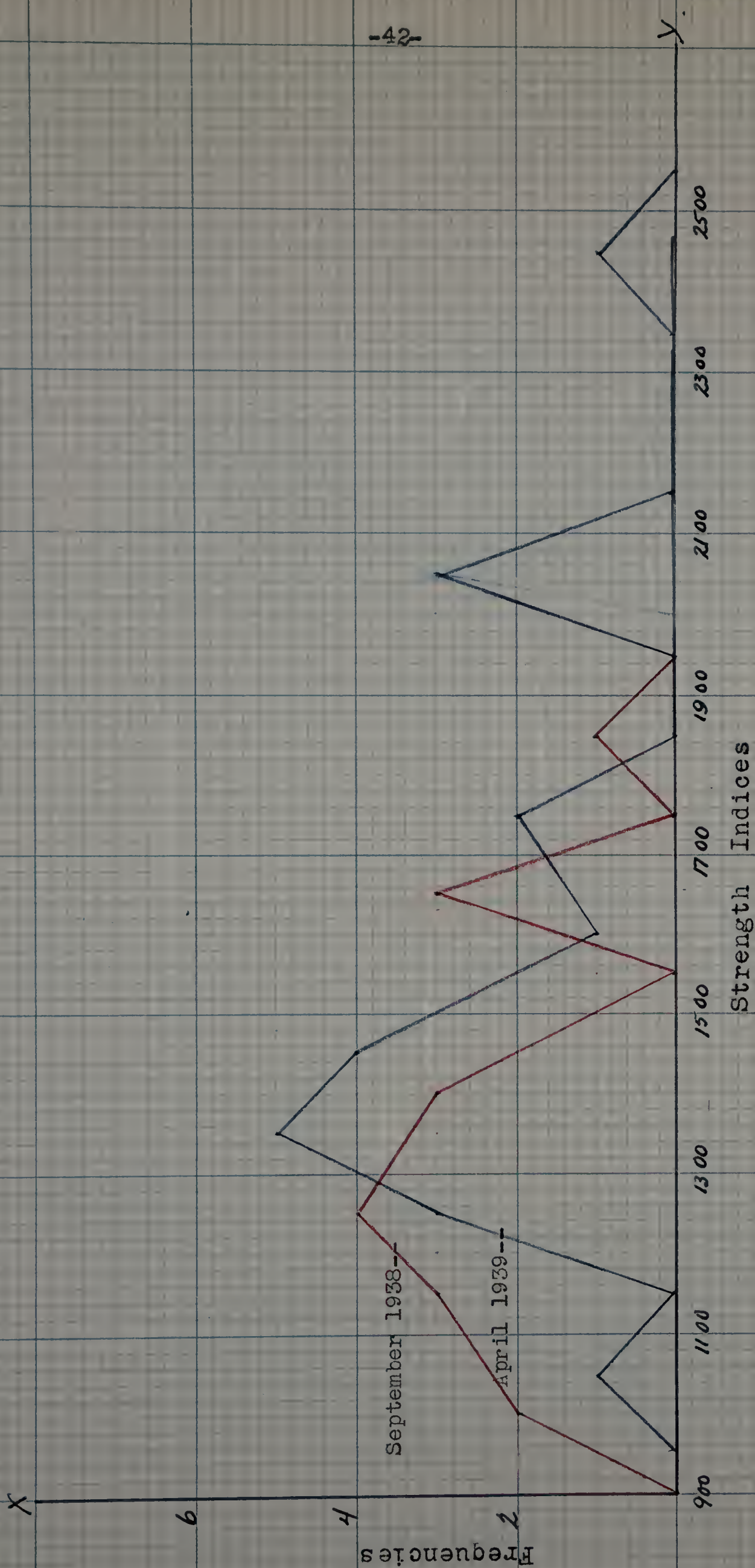
2300

2500

Strength Indices

Mean--1573.8
Standard Deviation--248
Median--1320

at Mass. State College
in September 1938 and April 1939
(Football-basketball Group)



The panel at the base of Graph XIII. shows the distribution of the Swimming group in the September, 1938, Physical Fitness Index tests; Graph XIV., the same group in April, 1939, Physical Fitness Index tests; Graph XV., comparison showing gain in the two test scores received in the Physical Fitness Index tests.

Graph XIII. shows the result of Physical Fitness Index scores taken of the swimming group (19 cases) in September, 1938, showing the mean (67.7), standard deviation (14.95), median (60.6), and range of 45-90.

Graph XIV. shows the April, 1939, scores, is found that the mean is 71.5 (an increase of 3.8), the standard deviation of 15.32. The median is 77.5 and the range has moved up to 45-100, which with the increase in the mean shows some improvement has taken place in the Physical Fitness Index of this group.

Graph XV. shows Physical Fitness Index distribution, the April, 1939, superimposed over the September, 1938, scores. This clarifies former remarks as to improvement of the scores for this group.

Summary of Results:

Median Physical Fitness Index Scores of Swimming Group

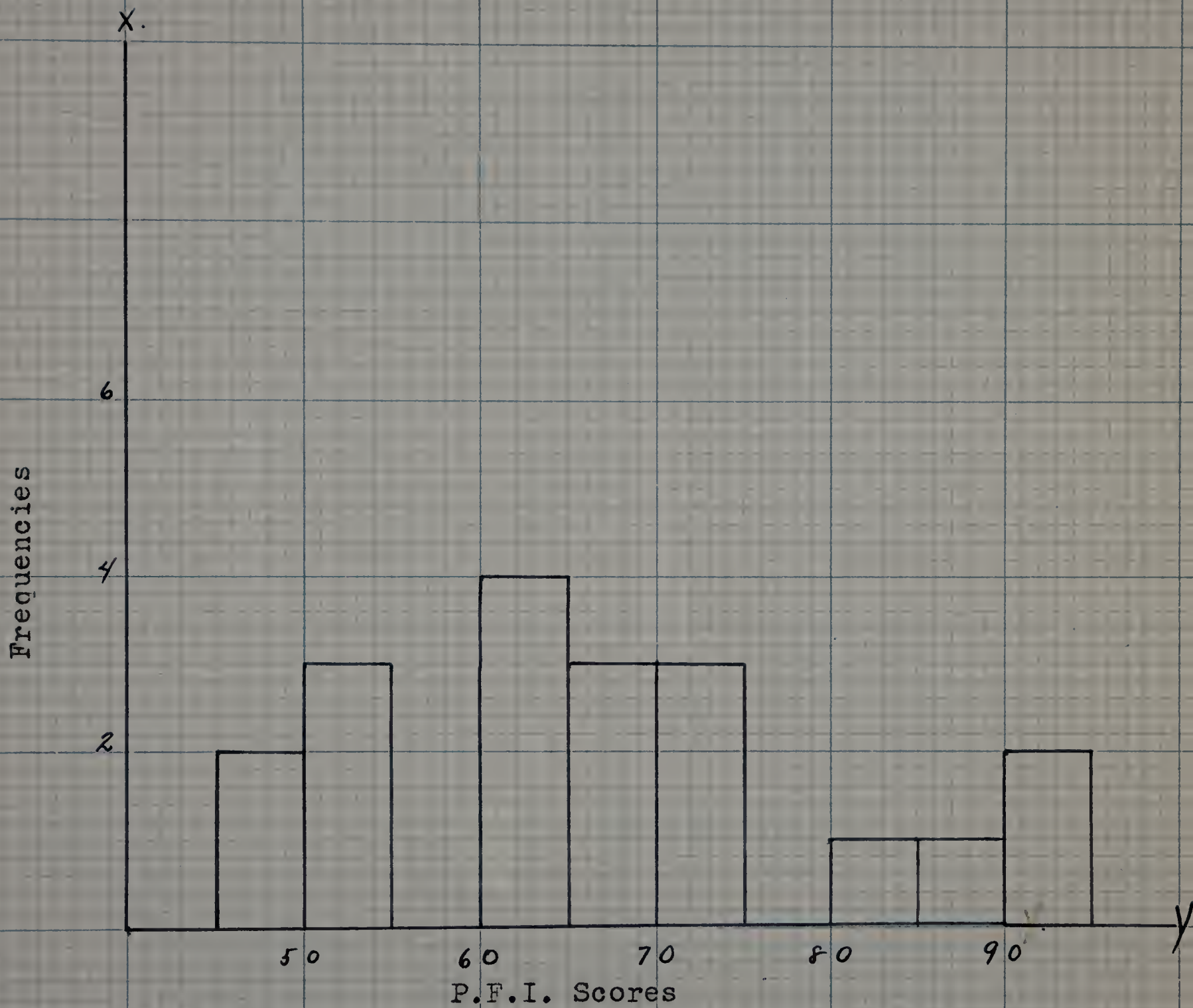
September, 1938	60.6
April, 1939	<u>77.5</u>
Gain	16.9

Results:

The above scores indicate that there has been a gain of 16.9 in the median and 3.8 in the mean.

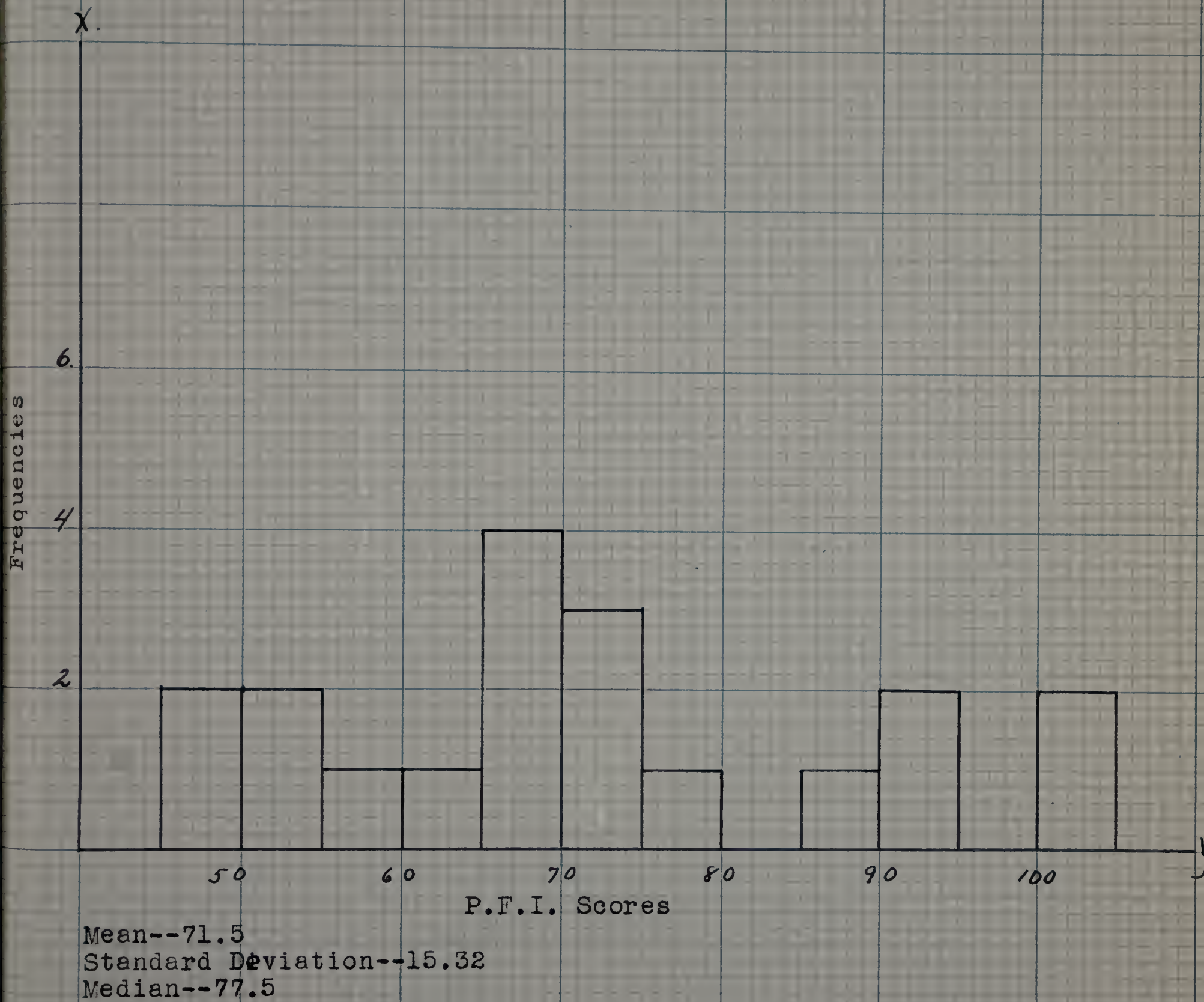
-44-
GRAPH XIII

Frequency Rectangles of P.F.I. Scores taken
at Mass. State College
in September 1938
(Swimming Group)



Mean 67.7
Standard Deviation--14.95
Median 60.6

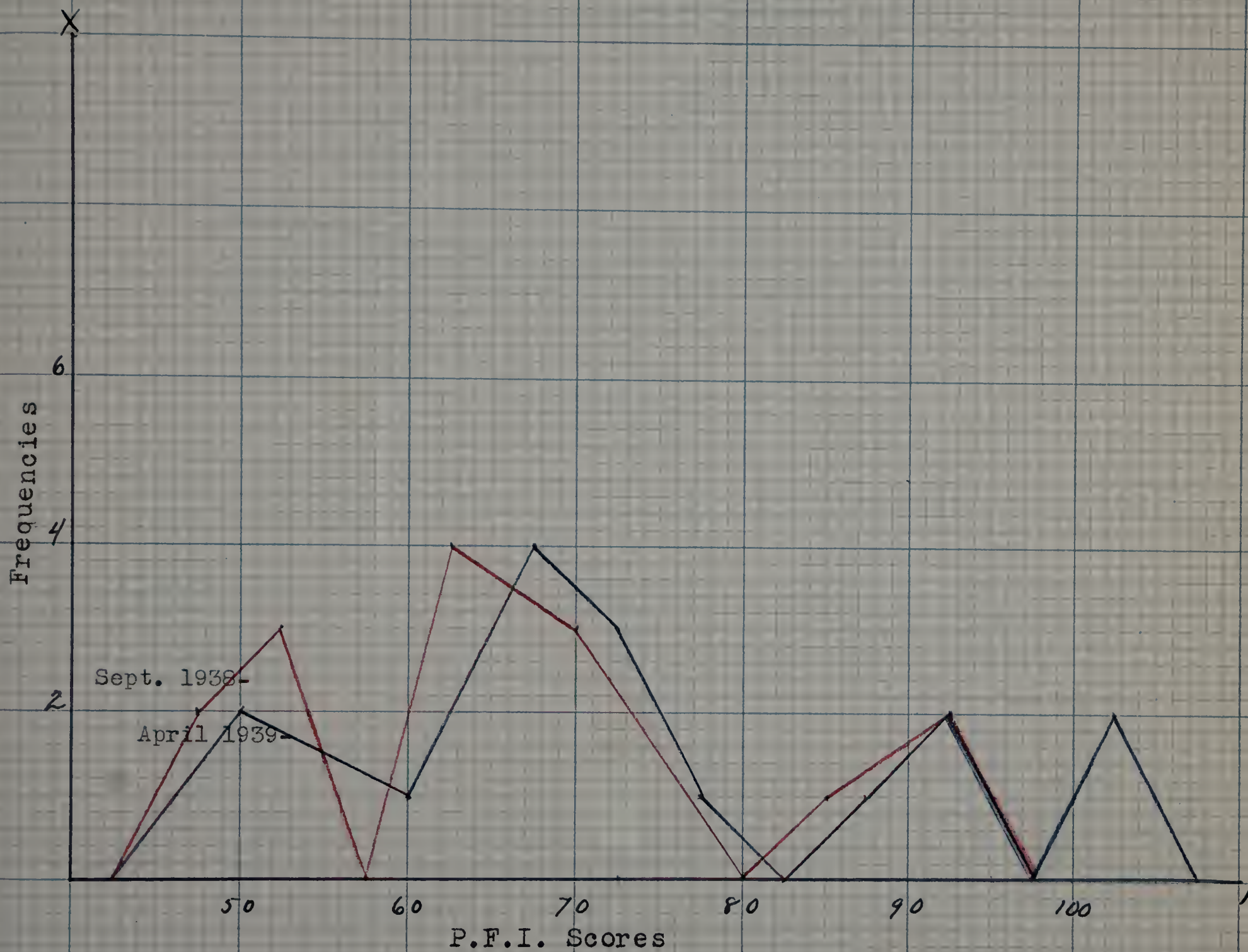
Frequency Rectangles of P.F.I. Scores taken
At Mass. State College
in April 1939
(Swimming group)



GRAPH XV

Frequency Polygon of P.F.I. Scores taken
at Mass. State College
in September 1938 and April 1939

(Swimming Group)



The panel at the base of Graph XVI. shows the distribution of the Swimming group in the September, 1938, Strength Index tests; Graph XVII., the same group in the April, 1939, Strength Index tests; Graph XVIII. comparison showing gain in the two test scores received in the Strength Index tests.

Graph XVI. shows the result of Strength Indices taken of the swimming group (19 cases) in September, 1938, showing the mean (1386.84), standard deviation (64), median (1150), and range of 800-2200.

Graph XVII. shows the April, 1939, scores, is found that the mean is 1413.16 (an increase of 26.32), the standard deviation of 270. The median is 1400 and the range has moved down to 1000-1900. There is still however, some improvement in the strength indices of this group as the mean is increased.

Graph XVIII. shows the Strength Indices distribution, the April, 1939, superimposed over the September, 1938, indices. This clarifies former remarks as to the improvement of the scores for this group.

Summary of Results:

Median Strength Index scores of Swimming Group

September, 1938	1150
April, 1939	<u>1400</u>
Gain	250

Results:

The above scores indicate that there has been a gain of 250 in the median and 26.32 in the mean.

at Mass. State College

in September 1938

(Swimming Group)

X

6

Frequencies

4

2

800

1000

1200

1400

1600

1800

2000

2200

2400

Strength Indices

Mean--1386.84

Standard Deviation--64

Median--1150

at Mass. State College

in April 1939

(Swimming Group)

X

6

4

2

Frequencies

-49-

y.

800

1000

1200

1400

1600

1800

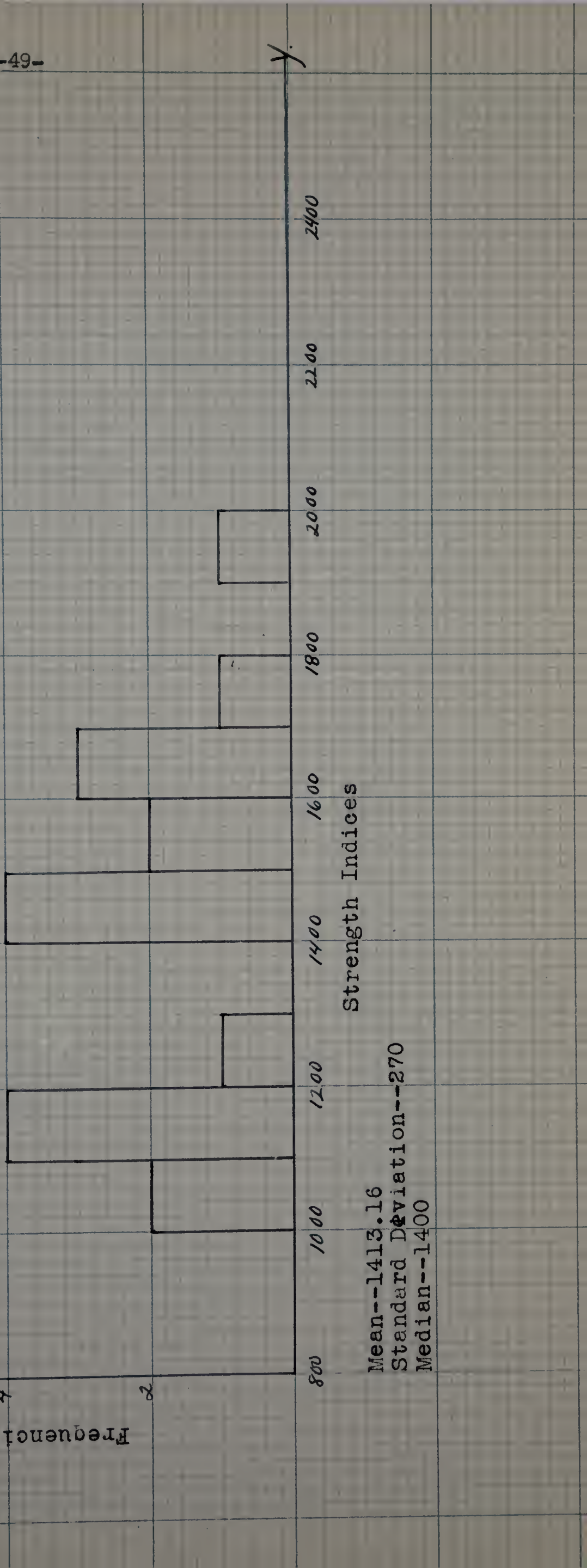
2000

2200

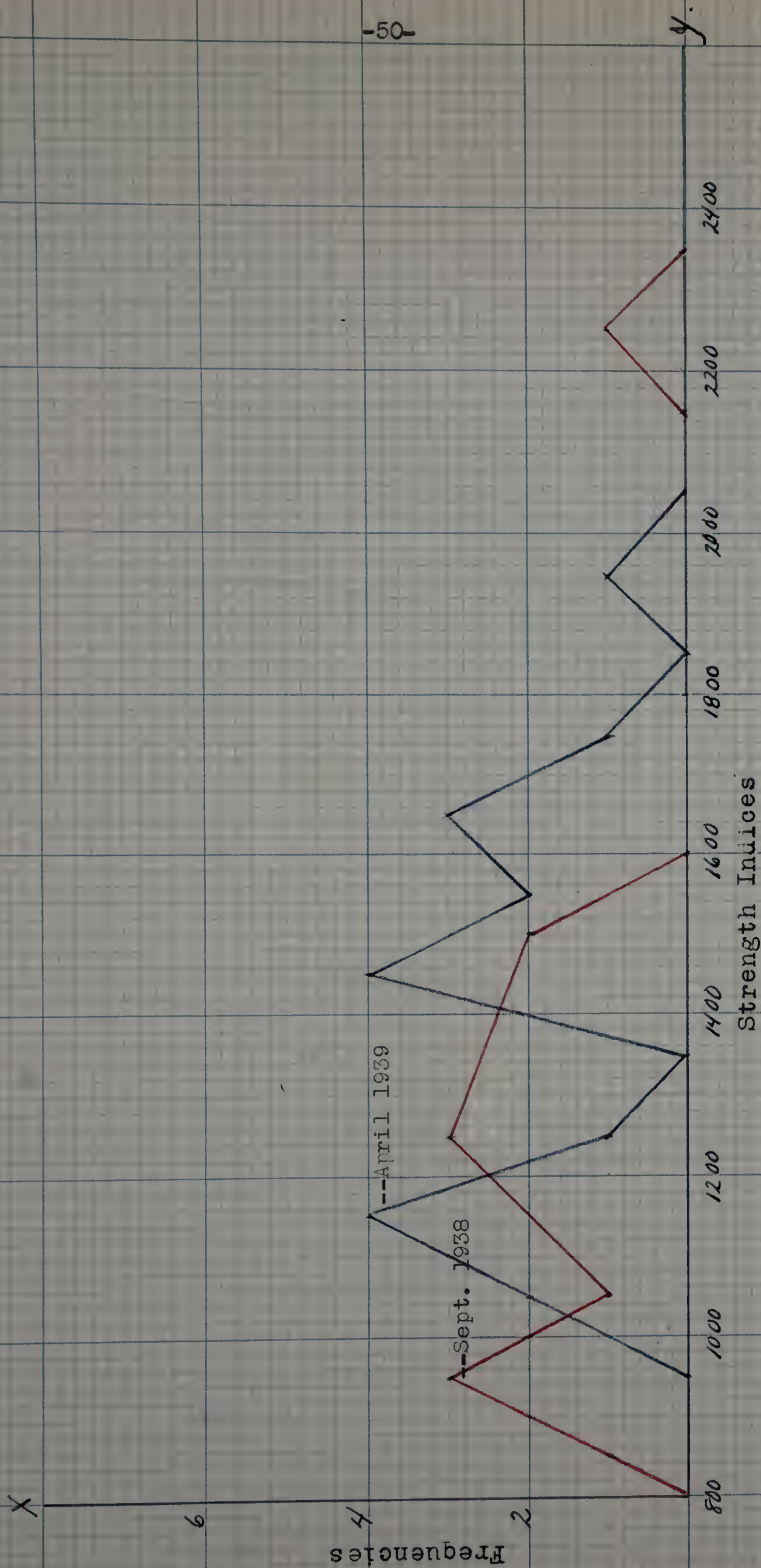
2400

Strength Indices

Mean--1413.16
Standard Deviation--270
Median--1400



at Mass. State College
in September 1938 and April 1939
(Swimming Group)



The panel at the base of Graph XIX shows the distribution of the Track group in the September, 1938, Physical Fitness Index tests; Graph XX, the same group in the April, 1939, Physical Fitness Index tests; Graph XXI., comparison showing gain in the two test scores received in the Physical Fitness Index tests.

Graph XIX. shows the result of Physical Fitness Index scores taken of the Track group (19 cases) in September, 1938, showing the mean (79.5), standard deviation (15.2), median 71.8), and range of 45-110.

Graph XX. shows the April, 1939, scores, is found that the mean is 82.7 (an increase of 3.2), the standard deviation of 14.2 (showing a more reliable mean), the median is 81.8 and the range has moved up to 50-120, which, with the increase in the mean, shows that some improvement has taken place in the Physical Fitness Index of this group.

Graph XXI. shows Physical Fitness Index distribution, the April, 1939, superimposed over the September, 1938, scores. This clarifies former remarks as to improvement of the scores for this group.

Summary of Results:

Median Physical Fitness Index scores of Track Group

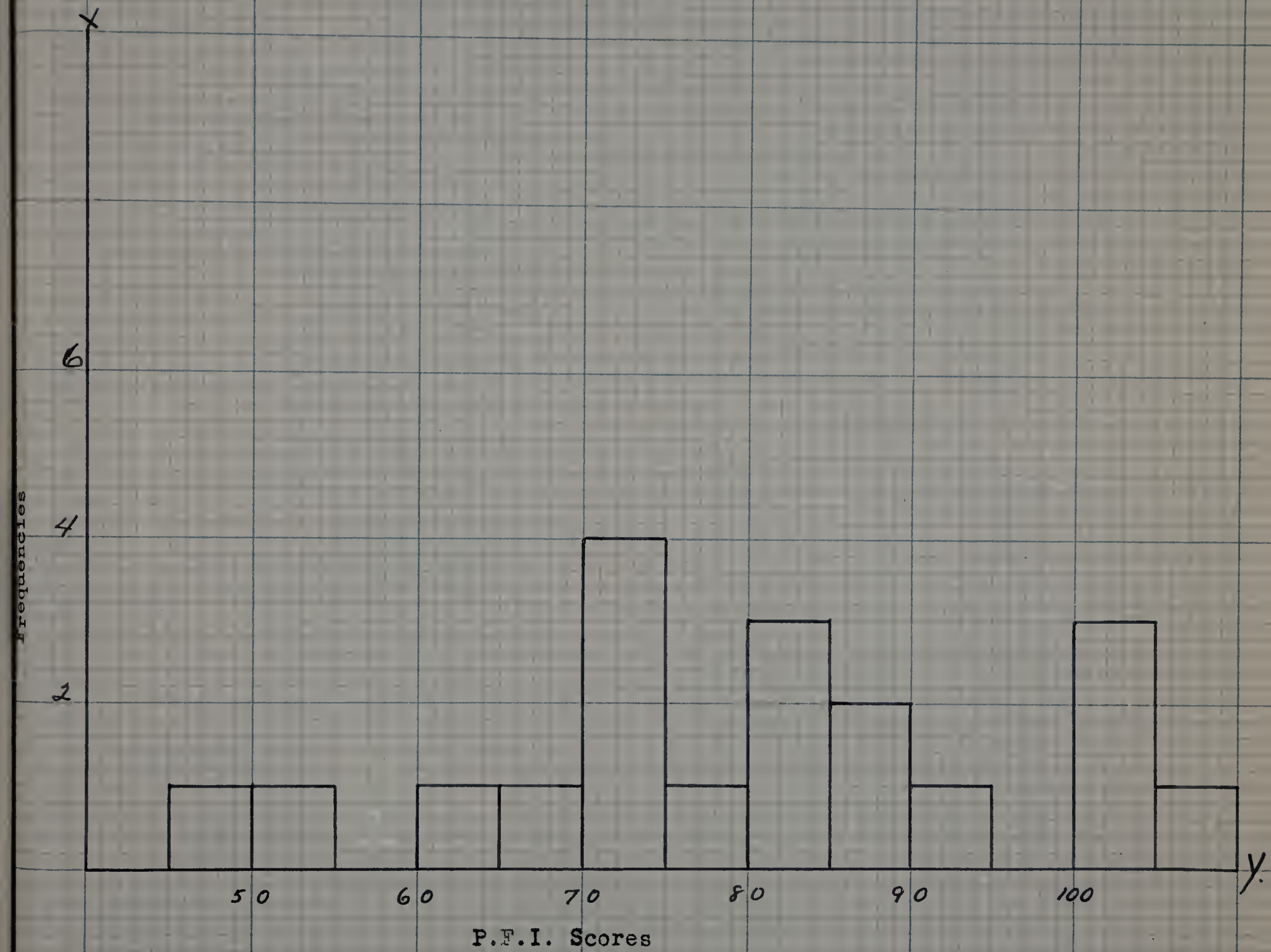
September, 1938	71.8
April, 1939	<u>81.8</u>
Gain	10

Results:

The above scores indicate that there has been a gain of 10 in the median and 3.2 in the mean.

-52-
GRAPH XIX

Frequency Rectangles of P.F.I. Scores taken
at Mass. State College
in September 1938
(Track Group)



Mean--79.5

Standard Deviation--15.2

Median--71.8

at Mass. State College

in April 1939

(Track Group)

X:

6

4

2

Frequencies

-53-

y

50

60

70

80

90

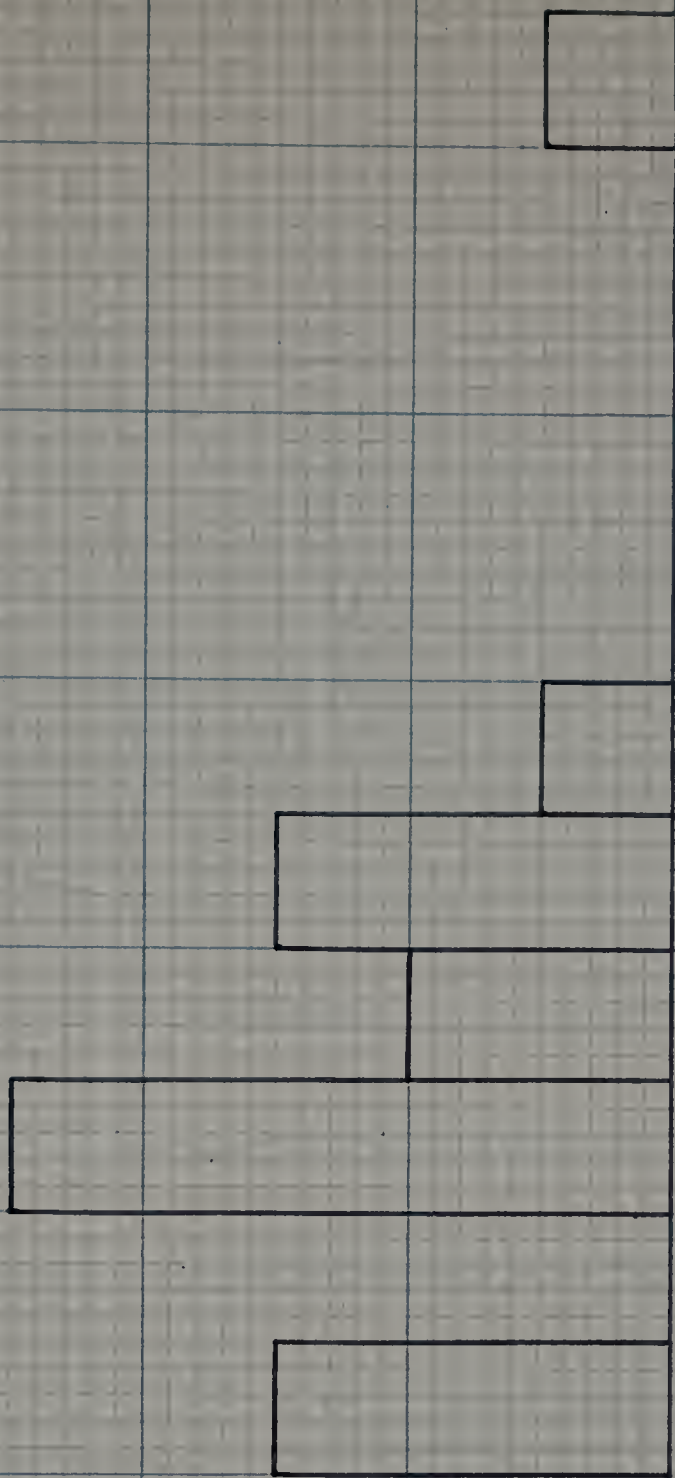
100

110

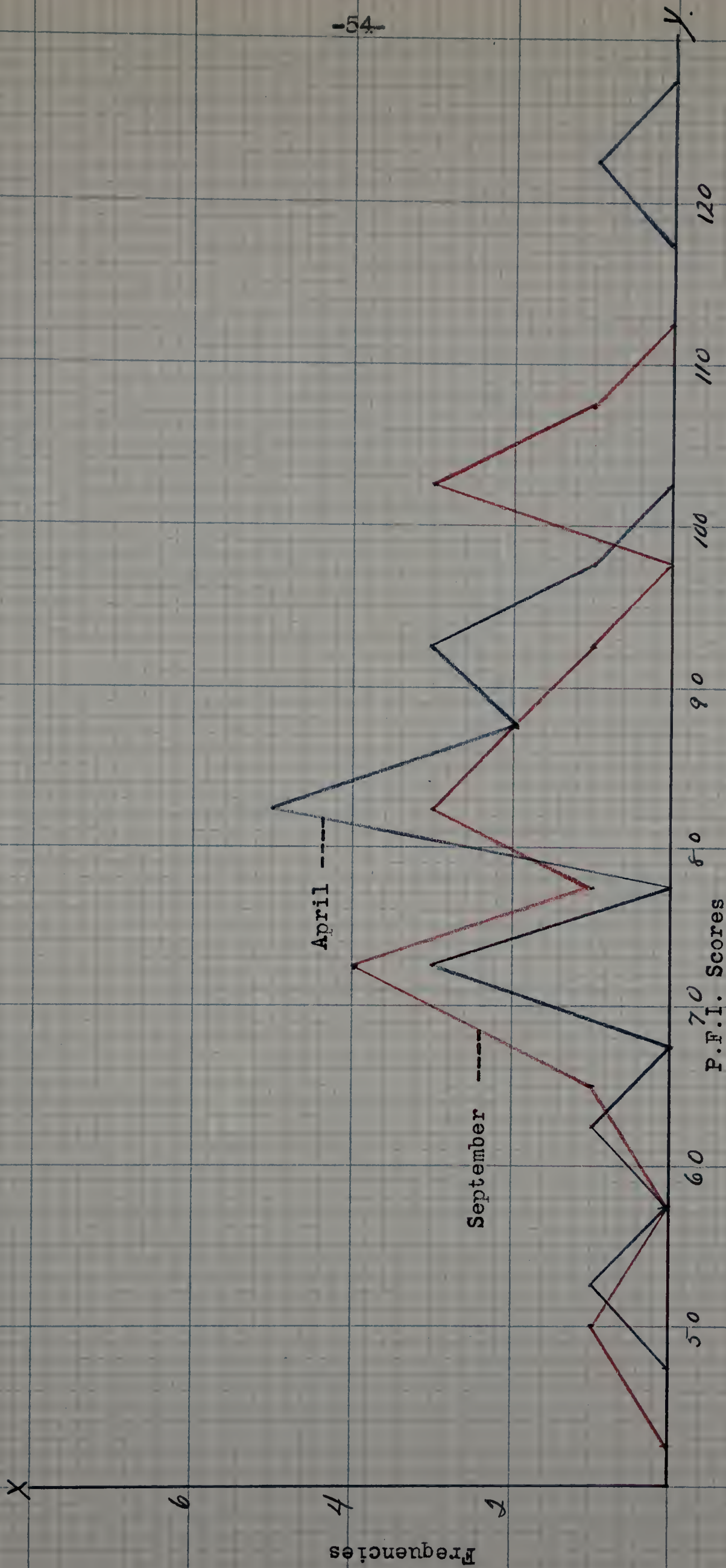
120

Mean--82.7
Standard Deviation 14.2
Median--81.8

P.F.I. Scores



At Mass. State College
in September 1938 and April 1939
(Track Group)



The panel at the base of Graph XXII., shows the distribution of the Track group in the September, 1938, Strength Index tests; Graph XXIII., the same group in the April, 1939, Strength Index tests; Graph XXIV., comparison showing gain in the two test scores received in the Strength Index tests.

Graph XXII. shows the result of Strength indices taken of the Track group (19 cases) in September, 1938, showing the mean (1371.05), standard deviation (257.6), median (1325), and range of 800-1900.

Graph XXIII. shows the April, 1939, scores, is found that the mean is 1607 (an increase of 236.95), the standard deviation of 235.6, The median is 1462.5 and the range has moved up to 1100-2100, which with the increase in the mean shows some improvement has taken place in the Strength Indices of this group.

Graph XXIV. shows the Strength Indices distribution, the April, 1939, superimposed over the September, 1938, indices. This clarifies former remarks as to improvement of the scores for this group.

Summary of Results:

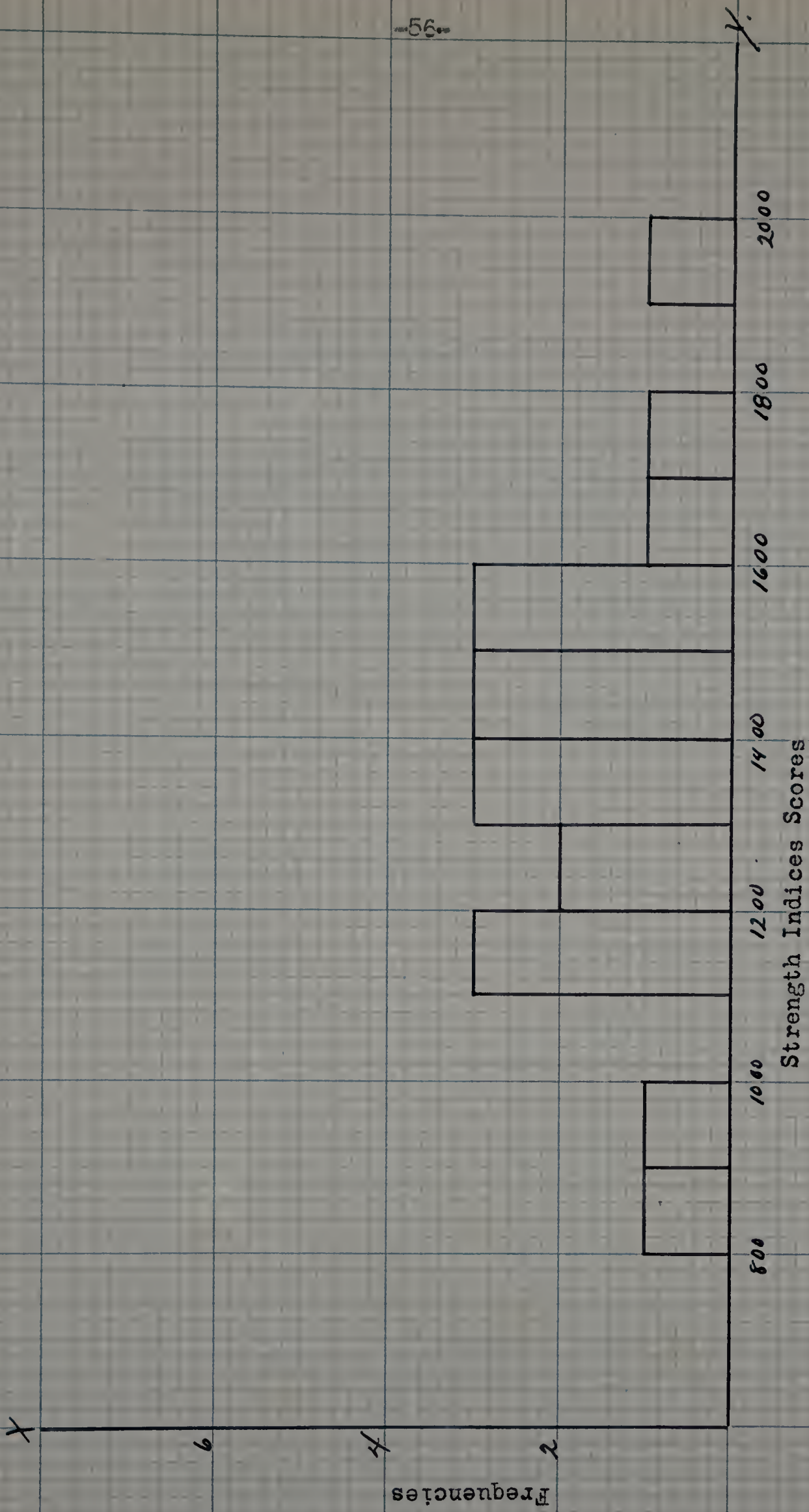
Median Strength Index Scores of Track Group:

September, 1938	1325.
April, 1939	<u>1462.25</u>
Gain	127.5

Results:

The above scores indicate that there has been a gain of 127.5 in the median and 236.95 in the mean.

at Mass. State College
in September 1938
(Track Group)



Mean--1371.05
Standard Deviation--257.6
Median--1325

at Mass. State College
in April 1939
(Track Group)

X.

6

4

2

Frequencies

-57-

Y.

800

1000

1200

1400

1600

1800

2000

Strength Indices Scores

Mean--1607.8

Standard Deviation--235.6

Median--1462.5

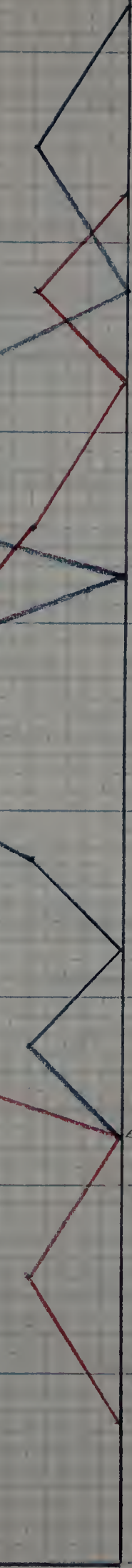
at Mass. State College
in September 1938 and April 1939
(Track Group)

Frequencies
2
4
6
8
X

September ----- April -----

Strength Indices Scores

800 1000 1200 1400 1600 1800 2000 2200



The panel at the base of Graph XXV. shows the distribution of the Football-basketball, Swimming and Track Groups in the September, 1938, Physical Fitness Index tests. Graph XXVI. shows the same groups in the April, 1939, Physical Fitness Index tests.

Graph XXV. shows comparative of mean Physical Fitness Index scores taken in September, 1938, of the three groups used for this study. The mean of the Football-basketball group was 62.9, the Swimming group 67.7, the Track group 79.5.

Graph XXVI. shows comparative of mean scores taken in April, 1939, of the same three groups. The mean of the Football-basketball group is 67.5 (an increase of 4.6), the Swimming group is 77.5 (an increase of 9.8), the Track group is 81.8 (an increase of 2.3). This clarifies previous statements as to improvement in the Physical Fitness Index scores for these groups.

Summary of Results:

Mean Physical Fitness Index Scores of Football-basketball, Swimming,

and Track Groups:	Football-basketball	Swimming	Track
September, 1938	62.9	67.7	79.5
April, 1939	<u>67.5</u>	<u>77.5</u>	<u>81.8</u>
Gain	4.6	9.8	2.3

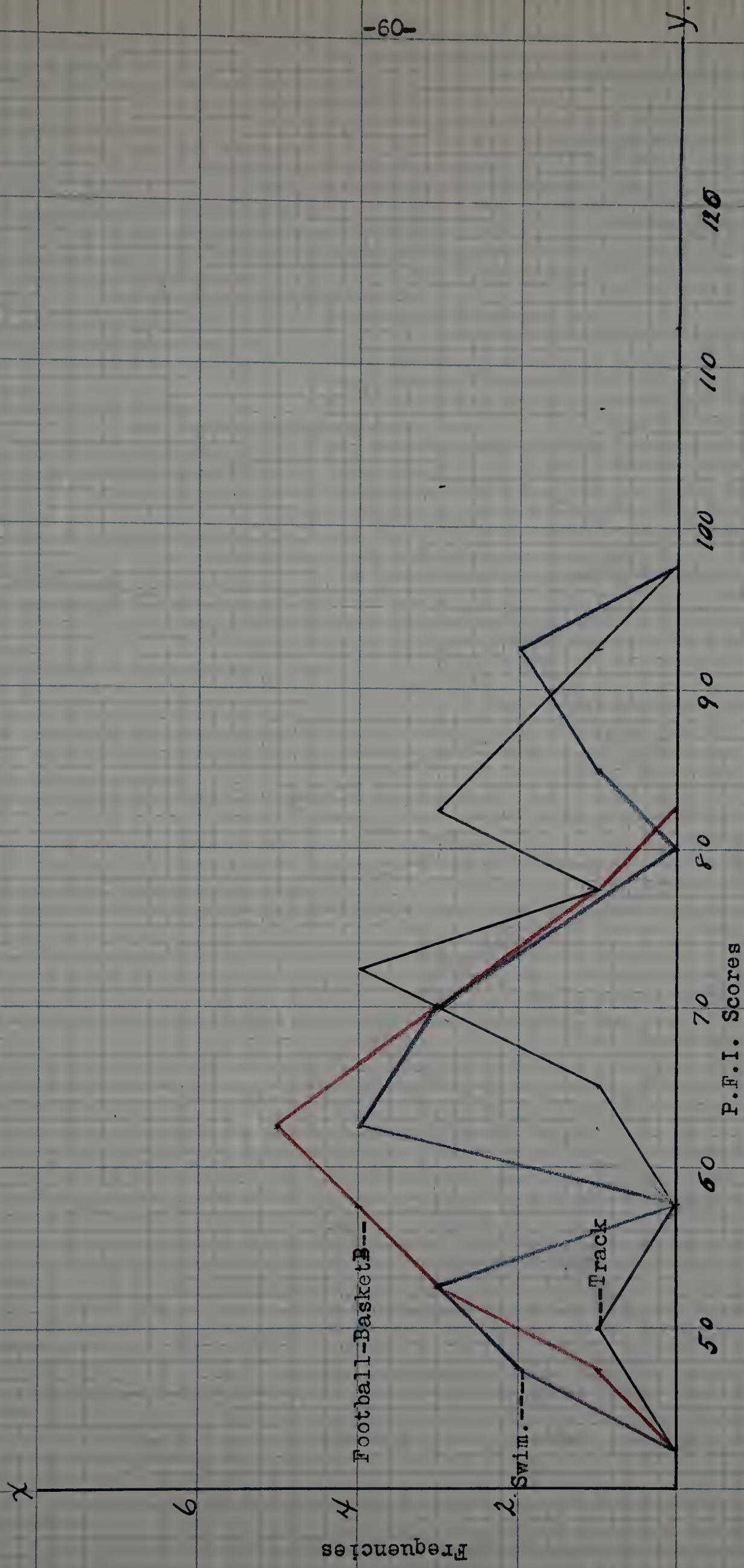
Results:

The above scores indicate that there has been a gain of 4.6 in the mean of the Football-basketball group, gain of 9.8 in the Swimming group, gain of 2.3 in the Track group.

at Mass. State College

in September 1938

(Showing relative scores in the Football-Basketball, Track,
and Swimming Groups)

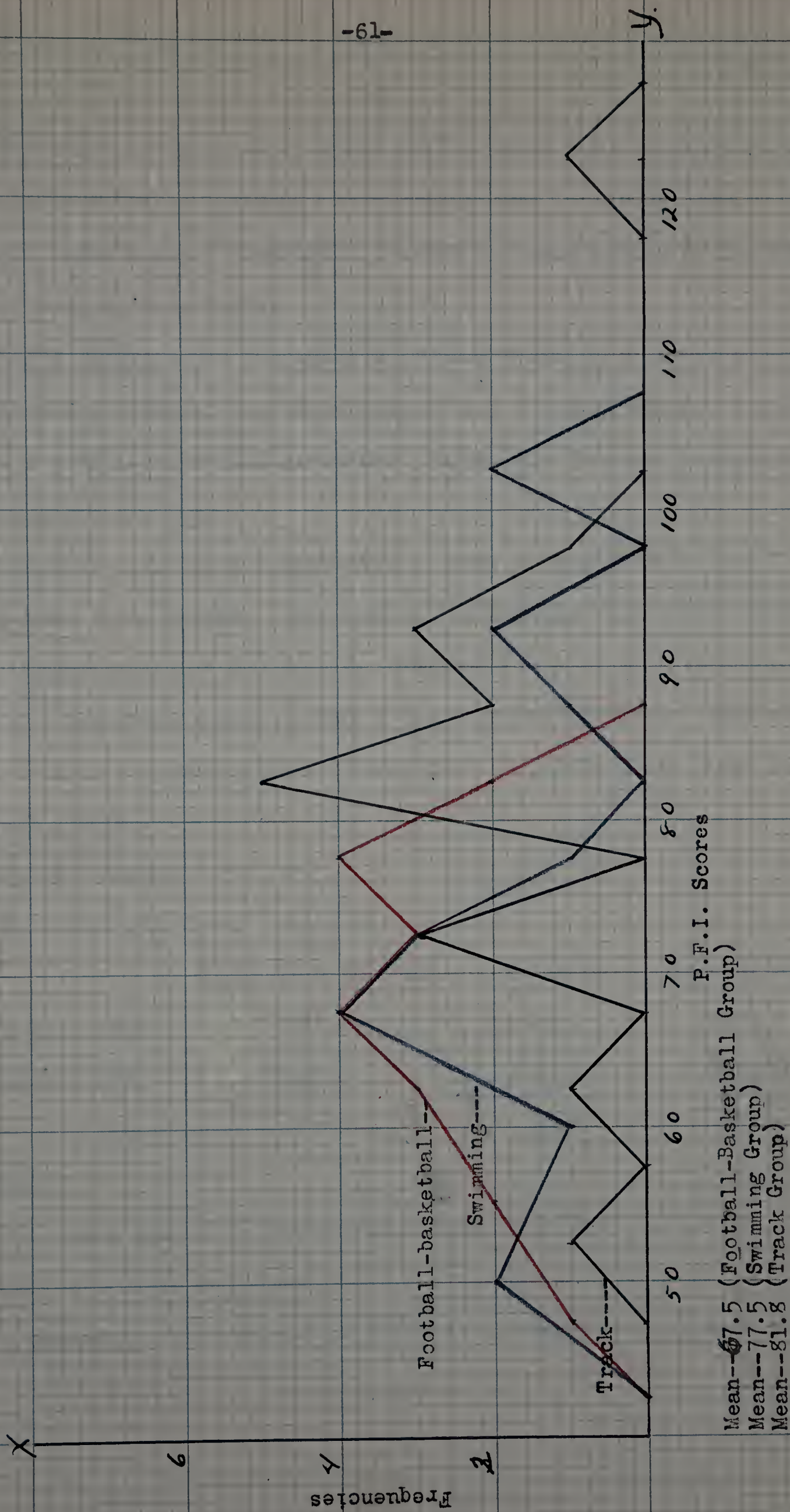


Mean--62.9 (Football-Basketball Group)
Mean--67.7 (Swimming Group)
Mean--79.5 (Track Group)

at Mass. State College

in April 1939

(Showing relative scores in the Football-Basketball, Track,
and Swimming Groups)



The panel at the base of Graph XXVII. shows the distribution of the Football-basketball, Swimming, and Track groups in the September, 1938, Strength Index tests. Graph XXVIII. shows the same groups in the April, 1939, Strength Index tests.

Graph XXVII. shows comparative of mean Strength Index scores taken in September, 1938, of the three groups used for this study. The mean of the Football-basketball group was 1321.4, the Swimming group 1386.8, the Track group 1371.0.

Graph XXVIII. shows comparative of mean scores taken in April, 1939, of the same three groups. The mean of the Football-basketball group is 1573.8 (an increase of 252.4), the Swimming group is 1413.1 (an increase of 26.3), the Track group is 1607.8 (an increase of 236.8). This clarifies previous statements as to improvement in the Strength Index scores of these groups.

Summary of Results:

Mean Strength Index scores of:

	Football-basketball	Swimming	Track group
Sept., 1938	1321.4	1386.8	1371.0
April, 1939	<u>1573.8</u>	<u>1413.1</u>	<u>1607.8</u>
Gain	252.4	26.3	236.8

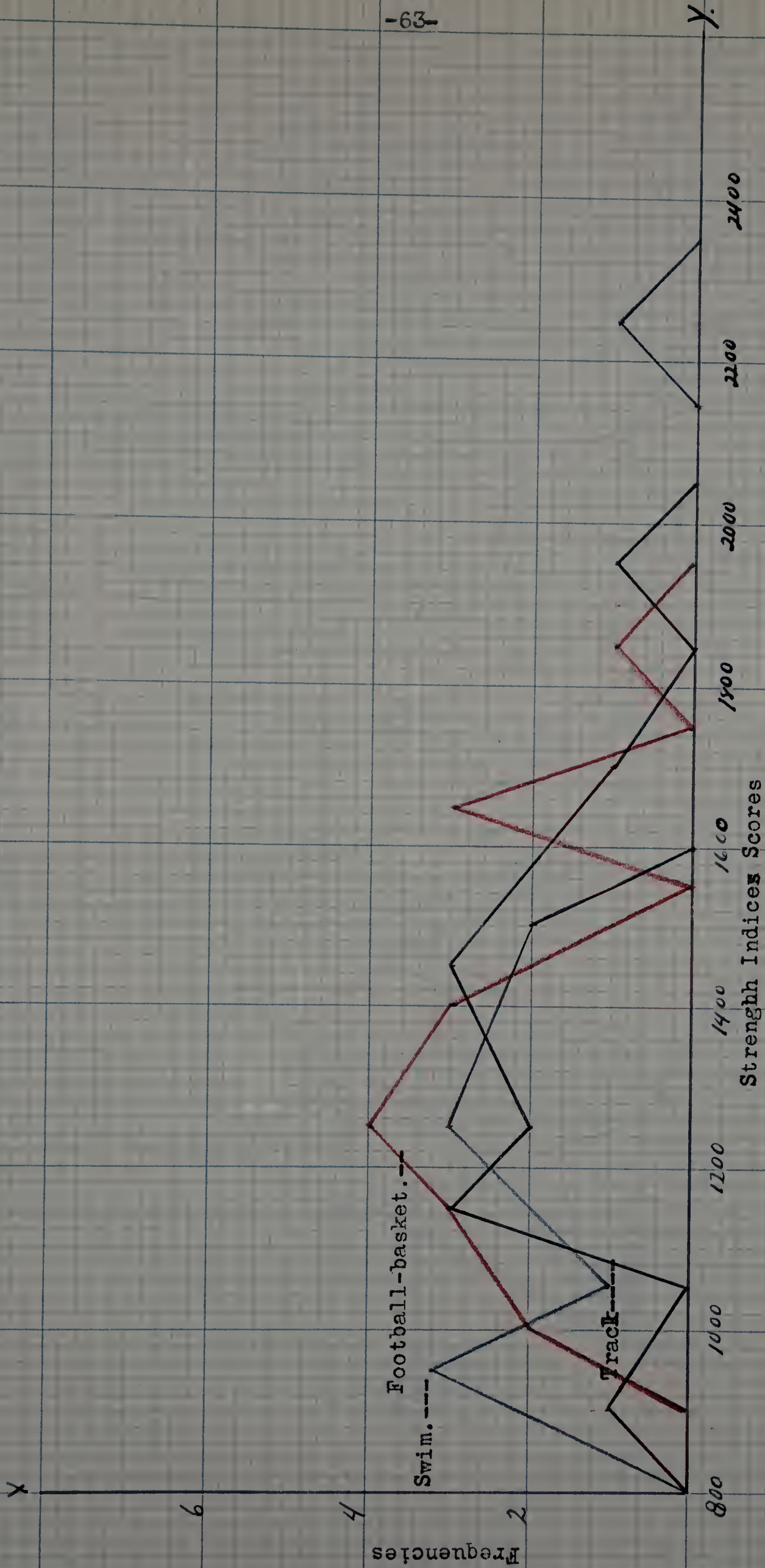
Results:

The above scores indicate that there has been a gain of 252.4 in the mean of the Football-basketball group, a gain of 26.3 in the mean of the Swimming group, a gain of 236.8 in the mean of the Track group.

at Mass. State College

, in September 1938

(Showing relative scores in the Football-Basketball, Track,
and Swimming Groups)



Mean--1321.4 (Football- Basketball Group)

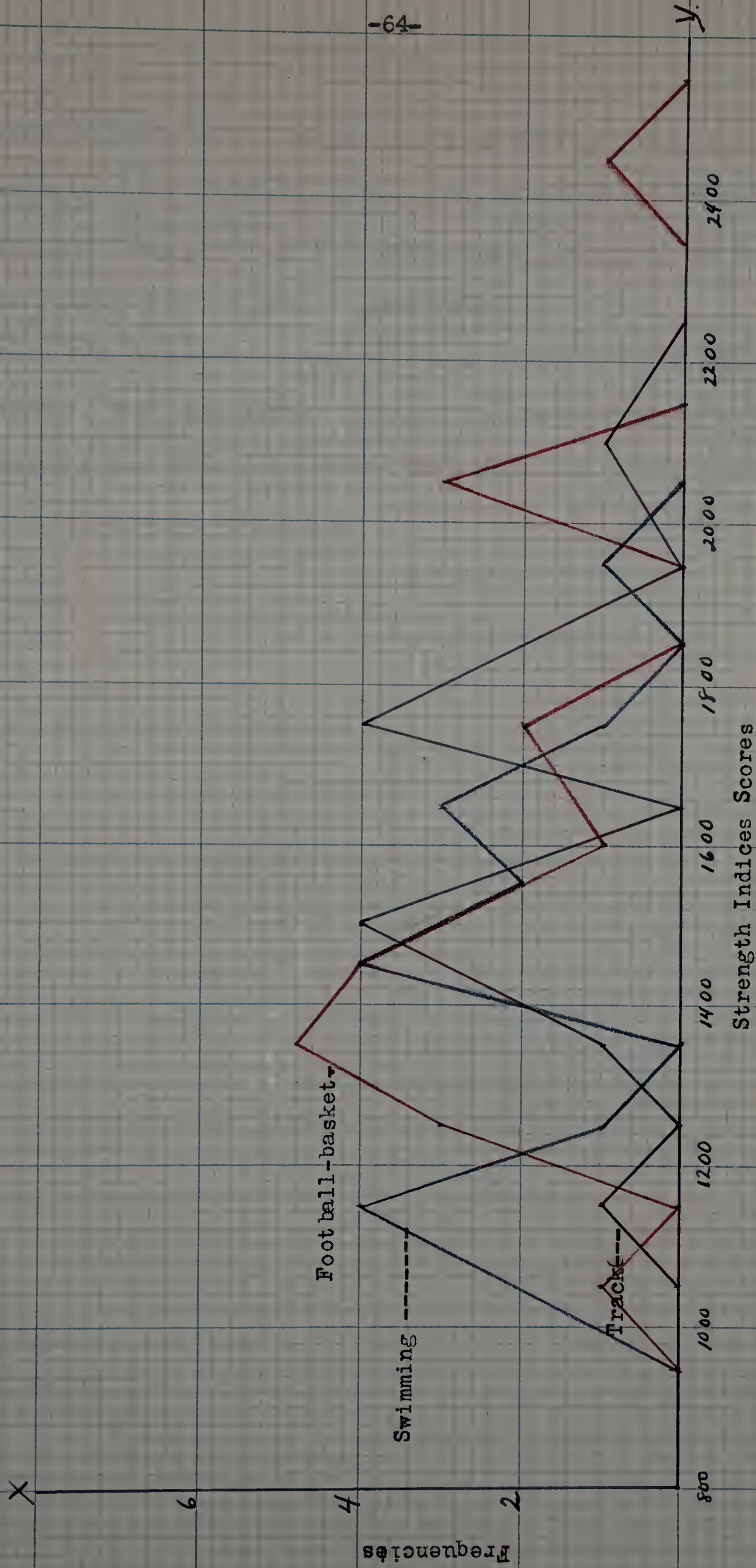
Mean--1386.8 (Swimming Group)

Mean--1371.0 (Track Group)

at Mass. State College

in April 1939

(Showing relative scores in the Football-basketball, Track
and Swimming Groups)



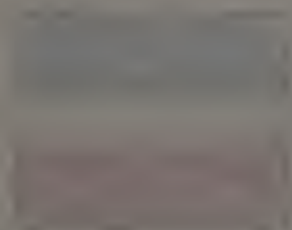
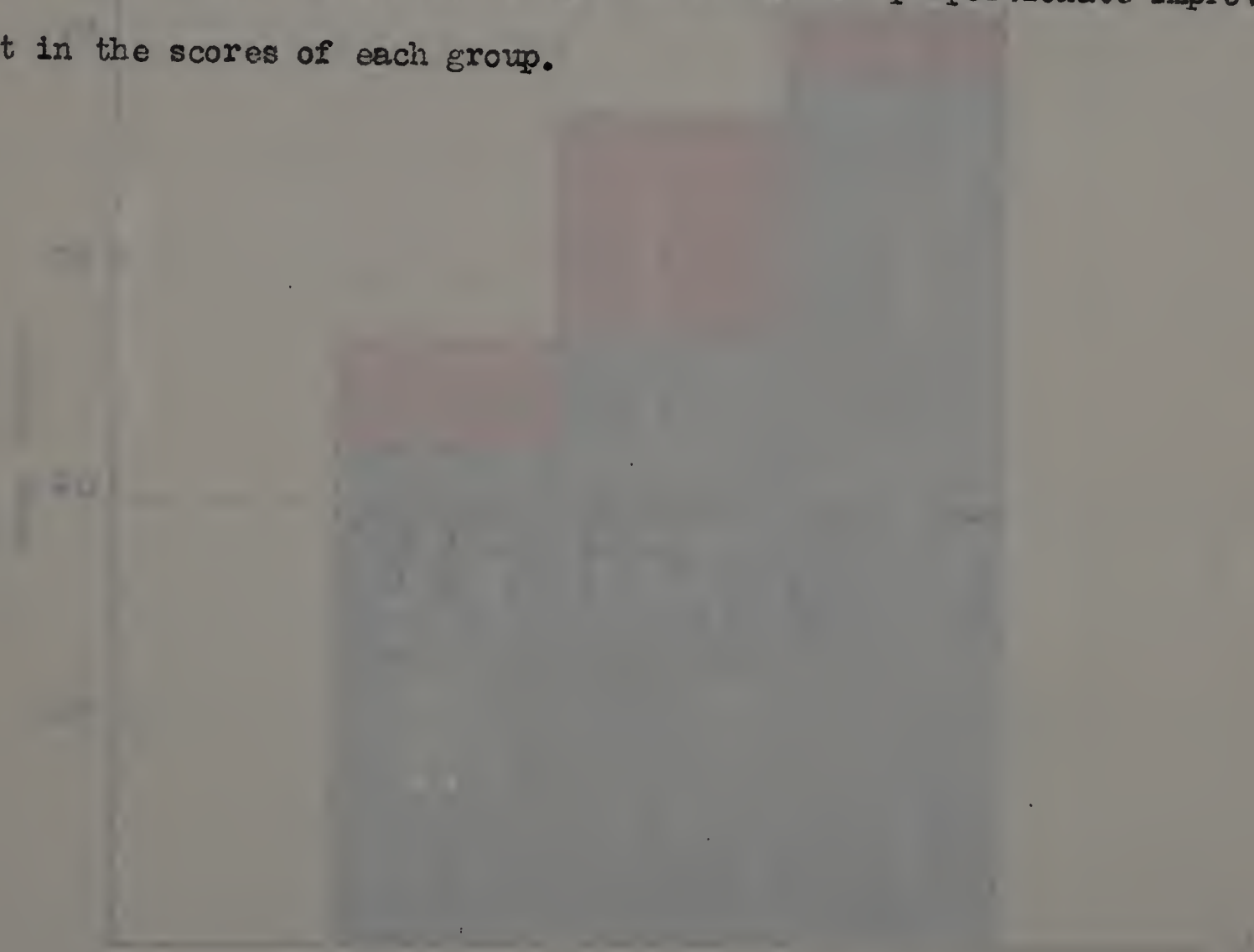
Mean--1573.8 (Football-basketball Group)

Mean--1413.1 (Swimming Group)

Mean--1607.8 (Track Group)

Graph XXIX. shows the comparative mean Physical Fitness Index scores taken in September, 1938, and April, 1939, of the Football-basketball, Swimming, and Track groups. This graph shows the actual and proportionate improvement in the scores of each group.

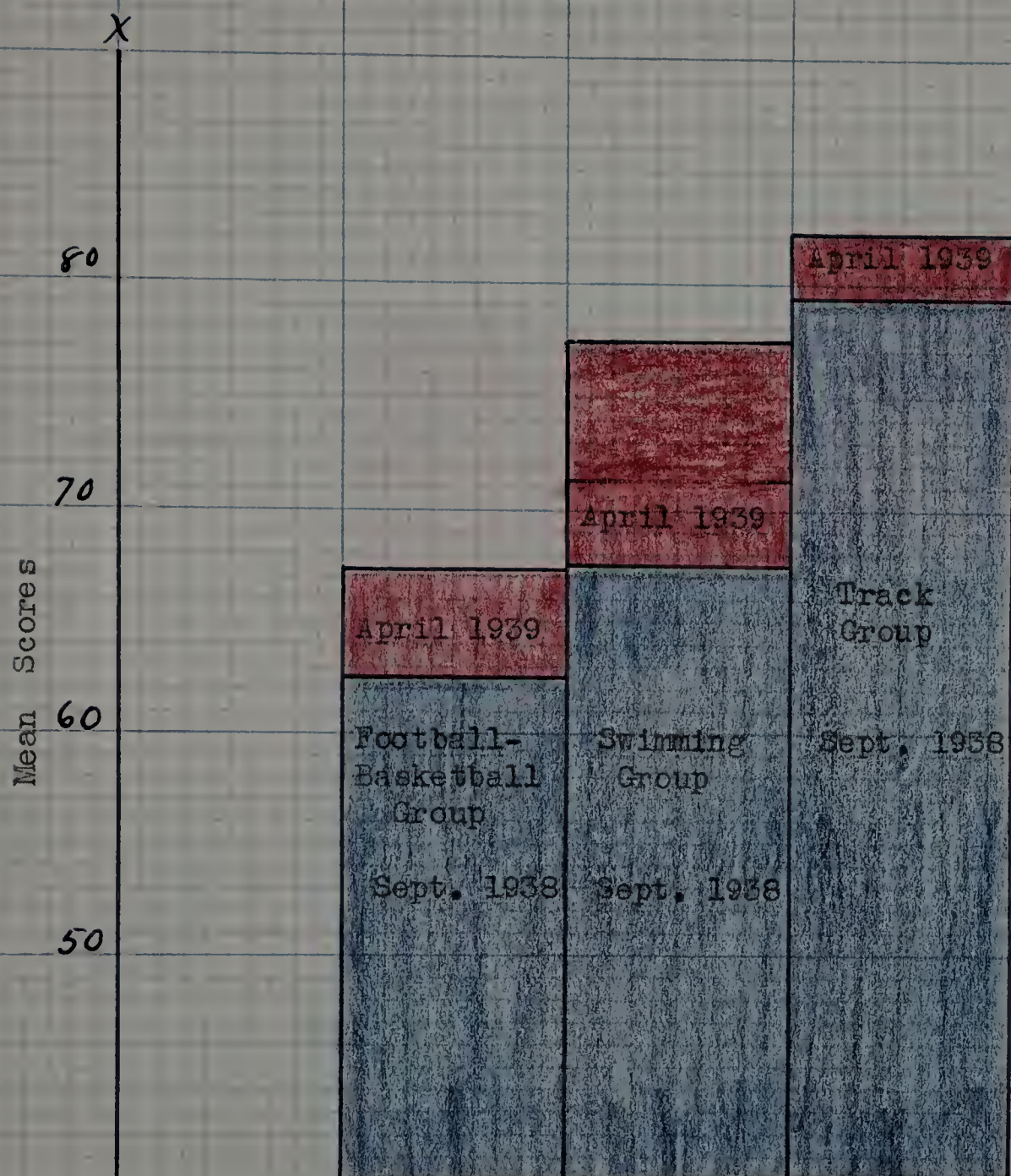
Graph XXX. Shows the comparative mean Strength Index scores taken in September, 1938, and April, 1939, of the Football-basketball, Swimming, and Track groups. This graph shows the actual and proportionate improvement in the scores of each group.



-66-
GRAPH XXIX

Frequency Rectangles of P.F.I. Scores taken
at Mass. State College
in September 1938 and April 1939

increase in
to show the Mean Scores of the Football-basketball,
Swimming and Track Groups

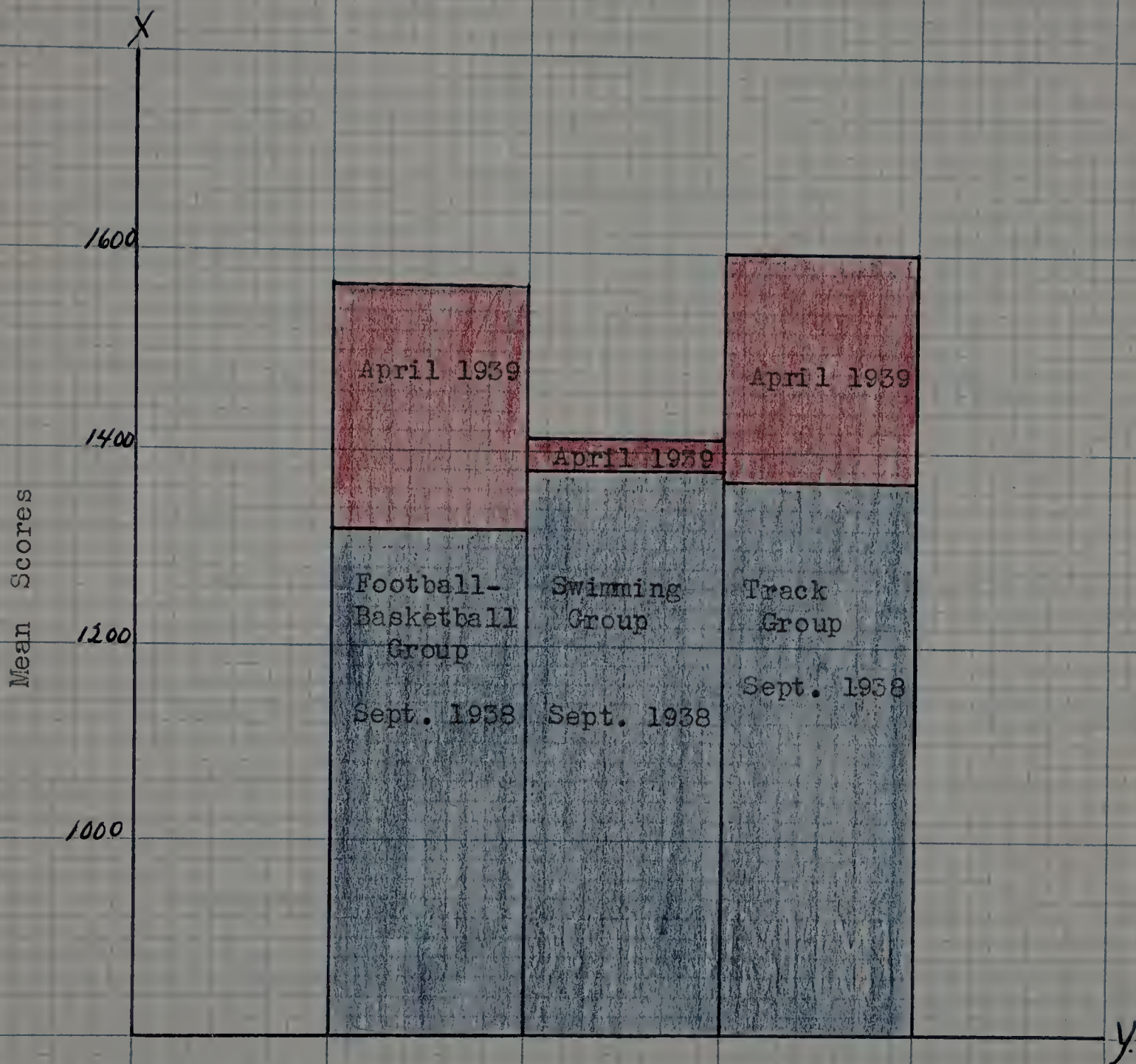


Blue indicates the September 1938 scores

Red indicates the gain in scores from September 1938 to April 1939

Frequency Rectangles of the Strength Indices taken
at Mass. State College
in September 1938 and April 1939

to show the ^{increase in} Mean Scores of the Football-basketball,
Swimming and Track Groups



Blue indicates the September 1938 scores



Red indicates the gain in scores from September 1938 to April 1939

Chapter VII.

STATEMENT OF CONCLUSIONS

1. The study reveals sufficient data showing that the required work and the several team game activities in the freshman physical education program at Massachusetts State College might have some effect on the scores obtained in the strength tests and physical fitness indices of the freshman men students.
 - A. There was an improvement in the strength and Physical Fitness Index scores of the group as a whole.
 - B. There was an improvement in the strength and Physical Fitness Index scores in all three of the various team game group combinations tested.
 - C. There was most improvement in Physical Fitness Index score in the Swimming group.

There was most improvement in strength score in the Football-basketball group.
 - D. The study has furnished figures for future reference in relation to the Strength and Physical Fitness Index tests with the college age level.
2. The increase found might be due to normal growth.
3. Results are not too scientifically significant; to be made absolutely valid, it would be necessary to have a test group through a period of years.

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Robert W. Vincent

Approved by:

W. H. Welles

J. A. Clague

Harold M. Gore

Graduate Committee

Date: May 18, 1939

